ANCIENT INDIA

Bulletin of the Archaeological Survey of India





NUMBER 22
1966

CONTENTS

EDITED AND PUBLISHED BY THE DIRECTOR GENERAL
ARCHAEOLOGICAL SURVEY OF INDIA, NEW DELHI
PRINTED AT THE JOB PRESS PRIVATE LTD., KANPUR
1973



ARCHAEOLOGICAL SURVEY OF INDIA

GOVERNMENT OF INDIA

Price : Rs. 15 or £ 1

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NOTES

READERS MAY RECALL THAT THE LAST ISSUE OF ANCIENT INDIA (Nos. 20 & 21) WAS published in 1967 as a double number for the years 1964–65. We offer our sincere apologies for the inordinate delay in the publication of this issue and hasten to add that it shall be our endeavour to bring out the subsequent issues as early as possible. We hope that the long-awaited publication of this issue will be welcome to readers.

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For the solution of the varied problems of Indian archaeology, the study of the archaeology of the neighbouring countries is a desideratum, for, India, throughout its long history, has been the recipient of many cultural traditions as also the fountain-head of many others which, in turn, spread to distant countries. During the last few years, these wider ramifications of Indian archaeology have been receiving some attention. In Nepal, excavations conducted at Tilaurakot and Kodan, jointly by Shrimati D. Mitra of the Archaeological Survey of India and the Department of Archaeology and Culture of His Majesty's Government of Nepal, have thrown a fresh light on the archaeology of Nepal. The excavation at the fortified town of Tilaurakot is the first scientific excavation conducted in Nepal. Apart from revealing the nature of the fortification, the work at the site has provided valuable ceramic sequence from the NBP Ware level to the beginning of the Christian era. At Kodan, two brick temples were laid bare, of which one is decorated with exquisitely carved bricks belonging to *circa* eight-ninth century A.D. Besides the above excavations, considerable part of the central *tarai* was explored and many historical sites were brought to light. The results of the work will be published shortly by His Majesty's Government of Nepal. During May and June 1963, an iconographical survey of Nepal was carried out under the direction of Shri Krishna Deva, jointly by the Archaeological Survey of India and the Department of Archaeology and Culture of His Majesty's Government of Nepal. In the present issue, there is also an article by the Survey's Prehistorian, Dr. R. V. Joshi, on the prehistoric exploration in Katmandu valley, Nepal, undertaken by him during September–October, 1961.

Not analogous with the objectives stated above, but of undoubted importance, is the work of preservation of monuments undertaken by the Archaeological Survey of India in the neighbouring countries. In Nepal, the seventeenth century mural paintings in the palace at Bhaktapur were chemically treated and preserved by a team of experts of the Survey.

The Survey has also undertaken work of preservation of the two world-famous colossal Buddhas at Bamiyan in Afghanistan in collaboration with the Afghan Government. This work was commenced in the year 1969, and within four seasons since then, the work on the 38-metre high Smaller Buddha, has been nearly completed. Cleaning and chemical preservation of paintings in the caves adjoining the central niche containing the Buddha image, have brought to light new paintings which were hitherto covered with soot, dust and other extraneous deposits. This work of great magnitude has been widely appreciated on account of (a) the very dextrous nature of the work, done by the Indian team in consolidating and holding back the badly fractured portion of the right wall of the main niche, and (b) restoration of the fallen parts of the caves, on the basis of the available clues. A good deal of restraint had to be exercised in the restoration of the missing parts, for any excessive reconstruction was not only unwarranted but would have amounted to introducing new features. It is now proposed to take up further conservation work to the Big Buddha in the coming years. All this has been possible with the active co-operation of the Afghan Government.

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A phenomenon of global magnitude which has been causing concern to many Governments is the theft and illicit trade in antiquities and art-objects. News keeps on coming from all quarters of the world of losses, thefts and smuggling of art-objects from museums, manuscript repositories and monuments. As a result of this world-wide craze for possession of antiques, India is also suffering. We have appealed to all the Museum Directors and Museum Managements to refrain from purchasing Indian antiquities (or, for that matter, any antiquity) without ascertaining the source. We avail of this forum to emphasize this appeal. We hope the world community of archaeologists and art-lovers will respond favourably to our appeal and not only abstain from acquiring antiquities exported through dubious means, but also bring to our notice agencies indulging in such activities. As a positive measure to protect our cultural heritage, we are taking various steps within the country, as also seeking the co-operation of the Interpol. Our Parliament has passed a new Act called The Antiquities and Art Treasures Act, 1972, which seeks 'to regulate the export trade in antiquities and art treasures, to provide for the prevention of smuggling of, and fraudulent dealings in antiquities, to provide for the compulsory acquisition of antiquities and art treasures for preservation in public places and to provide for certain other matters connected therewith or incidental or ancillary thereto.'

M. N. Deshpande

AMIRTHAMANGALAM 1955: A MEGALITHIC URN-BURIAL SITE IN DISTRICT CHINGLEPUT, TAMILNADU

By N. R. Banerjee

WITH CONTRIBUTIONS BY K. S. RAMACHANDRAN AND H. K. BOSE

CONTENTS

1. INTRODUCTORY

A. The problem and previous work

The exploration of the megalithic sites in District Chingleput in Tamilnadu, was taken up systematically by the Archaeological Survey of India under V. D. Krishnaswami from 1944 to 1948. It resulted in the discovery of more than two hundred megalithic sites containing numerous types and varieties[1] in the two geological zones (into which the District is broadly divisible), namely, the lateritic in the north covering the Taluks of Ponneri, Tiruvallur and Sriperumbudur, and the granitic in the south covering the remaining four Taluks of Saidapet, Chingleput, Kanchipuram and Madurantakam.

To corroborate the results of the ground-survey, it was decided to excavate the representative types of megaliths, and, with this end in view, Sanur, the largest of the typical and representative sites in the southern zone, was excavated in 1950 and 1952.[2]

The excavations at Sanur offered an opportunity to open the representative types of megaliths in Chingleput District except the barrows which are confined only to the northern or the lateritic zone. In order to have a clear picture about the barrows and their contents, it was decided to excavate Amirthamangalam which had already yielded pyriform urns. The purpose of the excavation at Amirthamangalam[3] was, therefore, to expose the burial-urns (without megalithic appendage) and establish their rôle and chronology in megalithism in general and in the Chingleput District in particular.

B. Acknowledgements

The excavation was carried out by the Southern Circle of the Archaeological Survey of India under the direction of the author with assistance from Shri K. S. Ramachandran, now Senior Technical Assistant in the Survey, Shri K. P. Balakrishnan, Foreman, Shri V. M. Naicker, Photographer (now retired), Shri T. Ganesan, Surveyor, and the late H. K. Bose, Assistant Anthropologist of the Anthropological Survey of India. I am grateful to all of them for their unstinted co-operation; to Shri H. K. Bose, I am deeply obliged for the preliminary report of the skeletal remains included here. Apart from working with the field-team he was engaged in the extremely careful and patient lifting of the skeletal remains.

2. THE SITE AND ITS ENVIRONS

The site at Amirthamangalam (pl. IA) in the laterite belt, in the Ponneri Taluk of the District, appears like a low laterite mound, turning almost to a peneplain. It lies on either side of the milestone 6 (10 km.) on the road from Kavaraipettai, on the Southern

[1] V. D. Krishnaswami and N. R. Banerjee, 'Megalithic monuments of the Chingleput District', paper presented to the 35th Indian Science Congress, Anthropology and Archaeology Section, Patna, 1948 (full paper not published); V. D. Krishnaswami, 'Megalithic Types of South India', *Ancient India*, no. 5 (1949), pp. 35–45; and K. R. Srinivasan and N. R. Banerjee, 'Survey of South Indian Megaliths', *Ancient India*, no. 9 (1953), pp. 103–15.

[2] N. R. Banerjee and K. V. Soundara Rajan, 'Sanur 1950 and 1952: a Megalithic Site in District Chingleput', *Ancient India*, no. 15 (1959), pp. 4–42. Subsequently Kunnattur in the granitic part of the Sriperumbudur Taluk was also excavated. See *Indian Archaeology 1955-56—A Review*, p. 23; *1956–57*, pp. 31–34; and *1957–58*, pp. 37–38.

[3] *Indian Archaeology 1954–55—A Review*, pp. 20–22 and N. R. Banerjee, 'The Megalithic Problem of Chingleput in the light of Recent Exploration', *Ancient India*, no. 12 (1956), p. 31.

Railway, to Satyavedu, at a distance of 30 miles (48·28 km.) to the north-north-east of Madras. The road running roughly east-west actually cuts up the site into two. The site is surrounded by the village Amirthamangalam, Guruvarajakandigai and Sripulalpettai on the north, by Suravarikandigai and Govindarajakandigai on the east, by Rajulakandigai, Chinnapuliyur and Periyapuliyur on the south, and by the Pulambedu village and a tank on the west.

The low laterite plateau slopes in a strike from the south-west to the north-east and is marked at the fringes by a number of minor and six major irrigation-tanks, the most prominent among which are the tanks at Pulambedu, Amirthamangalam and Karambedu on the north-east direction.

The laterite plateau is marked on the surface alternately by almost circular grassy and clayey patches, the latter having the appearance of low dunes or mounds (simulating barrows) marked by a spread of lateritic gravel with an occasional and very sparse occurrence of the chips of quartzite. The site is disturbed by quarry-pits, and the position has become worse by the formation of rain gullies running through the site on the southern side of the road. The exposed sections of the pits have laid bare a large number of burial-urns in various stages of destruction; the road itself passes apparently through the main concentration of the urn-burials.

A large number of palaeolithic tools in quartzite was also collected from the loosened lateritic gravel (detritus) in the area (high ground). These tools, in which the typical Madrasian biface or handaxe predominates, include ovates, chopper-chopping tools, rostrocarinates, tools of the Levallois technique and Clacton flakes. The flakes are comparatively few.

Two low dune-like formations on the northern side of the road were first chosen for excavation in the apparently undisturbed area, but they did not yield any burials. The dune-formation on the surface may be attributed either to erosion of the surrounding soft soil or to the human effort to cover up the burial-pits. The latter alternative seems to be more plausible, as outlines of several deliberately dug pits were traced on plan on the surface as well as in the exposed sections, in both halves of the mound. Pits thus dug were not utilized, but filled in again and covered like tumuli, an action which is difficult to explain.

3. SUMMARY OF THE RESULTS

The cultural equipment of the urn-burial site at Amirthamangalam belongs, without any doubt, to the megalithic order of south India. The urns containing post-excarnated skeletal remains constitute the bulk of the finds. In fact, this extensive site containing upwards of two hundred and fifty exposed and damaged urns display a large variety of sizes. Irrespective of their sizes, they vary in shape from oval to nearly globular form. The urns are invariably hand-made, of coarse texture, granular fabric and thick. All of them have a rolled rim, with or without additional decorations below the rim. They have either a pedunculated bottom, which obviously pins the urns into the earth and helps to keep them in position, or heeled solid bottoms, flat at the lower end, which vary in diameter from 4" (10 cm.) to 11" (27·9 cm.). The urns were placed in pits (pl. IB) of adequate dimensions, cut into the lateritic gravel and even, wherever necessary, into the underlying lateritic bed-rock. The skeletal material, consisting of a selection of uncalcined, disarticulated and excarnated bones including the skull, long bones, loosened teeth and fragments of ribs, were placed at the very bottom. Over the skeletal deposit were placed a few (three or four) pots in Black and red Ware, besides a near Black-and-red Ware suggesting inverted firing, and few iron objects. The urns were then filled

in with earth, and covered with a dome-shaped lid; a variant in the form of an oblong lid was also, though rarely, noticed. The lids being large and commodious, their rim come down to the belly-level of urns, proving thereby the extreme care of the authors to seal the burials completely. The lids have also a rolled rim and are of the same workmanship as that of the urns; both are pale red in colour. A few small fragile and almost non-utilitarian crude red ware pots were found to have been placed over the lid near its edge.

After the interment of the urn with the lid, the whole pit was covered up and sealed. Occasionally a few blocks of laterite, cut deliberately, appear to have been placed along the edge of the pit. The tumuli, if any, formed over the interments were not available. But the pits were sealed by an overlying layer of loose gravelly earth, the flattened top resulting from a possible re-deposition after the washing off of the surface by rains.

On the whole, these burials appear to be simpler than the elaborate megalithic burials. The absence of the stone-circle, which is a very common feature of megaliths, the paucity of pottery and iron objects, and the small quantity of skeletal material tend to suggest a less sophisticated and conventional mode of disposal of the dead, perhaps even indicating a later date for the urn-burials than that of the other types of megaliths. In this context the occurrence of a few straggling bits of laterite stones at the edge of the pit may perhaps be taken as the relics of the stone-circle.

4. CHRONOLOGY

The site, indeed, has not yielded any internal evidence on chronology. The urns were without the usual megalithic appendage of the stone-circle, and this fact implies, on the whole, much less effort than that used in the construction of elaborate megalithic tombs, though the remains of an apparent stone-circle on a miniature scale has been observed at Amirthamangalam. The absence of an enclosing circle of stones by itself cannot be taken as a basis of chronology, as the simplicity of form can, with equal force, be applied to the incipient stage as to the decadent. In view of the trend of the megalithic evolution being accepted largely as from the north or north-west to the south, the urn-burials at the site generally would belong, by its location in an intermediate zone, to an early period, though the precise position of the particular tombs in the chronological order cannot be pronounced upon with exactness or emphasis. There is hardly any doubt that the culture represented by the urn-burials belongs to the megalithic-complex of south India. Wheeler[1] had earlier suggested a date-range of circa 200 B.C. to A.D. 50. But the recent trend is to push back the date of the beginning of the megalithic culture to about the eighth century B.C.[2] The radiocarbon dates[3] for the chalcolithic cultures at

[1]R. E. M. Wheeler, 'Brahmagiri and Chandravalli 1947: Megalithic and other Cultures in the Chitaldrug District, Mysore State', *Ancient India*, no. 4 (July 1947–January 1948), p. 202; *Early India and Pakistan* (London, 1959), p. 163.

[2]The possibility of an earlier date was first indicated by the author, Banerjee, *op. cit.* (1956), pp. 32–34. The views were later briefly expressed in 'Le probleme des megalithes aux Inde', *Antiquites Nationales et Internationales*, Vols. III and IV (1960), pp. 72–73, and later at the First International Congress on megaliths held in Paris, February, 1961. The position has been dealt with at length by the author in *The Iron Age in India* (Delhi, 1965). The 1966 evidence from Hallur, District Dharwar, Mysore, relating to the date of overlap between the neolithic and megalithic cultures in 955±100 B.C. and 1105±105 B.C. (TF 573 and TF 570) remains yet to be corroborated elsewhere.

[3]B. B. Lal, 'A picture emerges—an assessment of the carbon-14 datings of the protohistoric cultures of the Indo-Pakistan subcontinent', *Ancient India*, nos. 18 & 19 (1962 & 1963), pp. 215–16.

Eran and Nevasa clearly place its lower level to 600 B.C. and the fact of its overlap with the megalithic culture at several sites, such as Brahmagiri, Sanganakallu (Kupgal)[1] and Tekkalakota[2] in District Bellary and Hallur[3] in District Dharwar, in Mysore, and Paiyampalli[4] in District North Arcot, Tamilnadu, a date in the neighbourhood of 700 B.C. at the earliest is clearly established.

Conversely, it has been argued that since the white-painted black-and-red ware has been found at Madurai, not very far from Adichchanallur[5] in District Tirunelveli, not to speak of the still northern specimens at Perumbair in District Chingleput, and as the ware has been found in association with the megalithic wares at T. Kallupatti[6] in District Madurai, it is more likely for the megalithic culture to have begun in the tip of the peninsula at or near Adichchanallur, and from this centre spread towards the north.[7] In this context, it may be added that the white-painted ware has been recently discovered from the megalithic levels at Sanganakallu and Hallur.[8] The discovery of pre-iron megalithic monuments in Uttar Pradesh,[9] and a broad cultural homogeneity prevailing throughout the peninsula would warrant reconsideration of such views.

It is not possible in this context to indicate an absolute date for the urn-burials at Amirthamangalam, though the possibility of their being slightly later than the date of the inception of the megalithic culture may perhaps be stated without any partisan emphasis. By their apparent similarity with the urn-burials at Amaravati, they can be dated to about the same period. It is clearly established that the urn-burials at Amaravati are stratigraphically earlier than the main *stūpa*, the earliest date of which goes back to the third-second century B.C. The urns at Amirthamangalam should, therefore, be assigned to a date prior at least to the third century B.C. This is at best provisional.

5. GENERAL OBSERVATIONS

The urn-burials at Amirthamangalam have several distinctive features. The diagnostic megalithic feature in the form of the bounding stone-circle is, however, missing[10] here, although vestiges of the latter is, as stated above (p. 6), sometimes present in a diminutive but definite, though not utilitarian, form. The stone-circle is absent at Adichchanallur[11] as well. A diminutive stone-circle, in an ill-preserved and discontinuous form, is found around the urn-burial covered by a stone slab at Porkalam,[12] District Trichur, Kerala,

[1] *Indian Archaeology 1964–65—A Review*, pp. 29–30.

[2] Information from Dr M. S. Nagaraja Rao and *Indian Archaeology 1963-64—A Review*, pp. 24–25.

[3] *Ibid., 1964–65*, pp. 31–32.

[4] *Ibid.*, pp. 22–23.

[5] B. Subbarao, *The Personality of India*, Second Edition (Baroda, 1958), p. 176.

[6] *Indian Archaeology 1958–59—A Review*, p. 31.

[7] K. V. Soundara Rajan, 'The Iron Age Culture Provinces of India', *Bharatiya Vidya*, vol. XXIII (1963), nos. 1 to 4, pp. 1–21.

[8] *Indian Archaeology 1963–64—A Review*, pp. 31–32.

[9] *Ibid.*, pp. 57–58, and information from Shri G. R. Sharma.

[10] B. K. Thapar, 'Porkalam 1948: Excavation of a megalithic Urn-burial', *Ancient India*, no. 8 (1952), p. 5, states that the circles in many cases are *now* missing (italics mine). There is indeed no evidence to suggest that there was invariably a circle around an individual urn. At least it was not so at Amirthamangalam.

[11] A. Rea, 'Some prehistoric burial places in southern India', *Journal of the Asiatic Society of Bengal*, LVII, pt. I (1888), pp. 48 ff.

[12] Thapar, *op. cit.* (1948), p. 6.

which may suggest a homogeneous similarity with the urn-burials at Amirthamangalam despite a great distance between the two sites. It is, indeed, not necessary for the circle to be invariably present. In fact, urn-burials without this megalithic appendage were excavated at Maski[1] within the megalithic-complex. In view of the extensive occurrence of urn-burials throughout the megalithic zone in the peninsula, they have to be considered as part and parcel of the megalithic ensemble.

Urn-burials in India have a very long history dating back to the Cemetery H Period at Harappa. But the connection of the megalithic urn-burial with that of the Cemetery H is not known. It is, however, certain that it was once a very widespread custom and Tamil literature[2] and tradition have preserved several references to the urn-fields and megalithic burials. In fact, megalithic urn-burials became very popular in the south. Apart from the recent excavation of urn-burials at Porkalam in Kerala, Amirthamangalam in Tamilnadu and Yelleswaram[3] in Andhra Pradesh, evidence about the urn-burials and their contents, recovered by exposure or excavations, has been forthcoming from all over south India. These include many sites in Tirunelveli,[4] of which those at Kilnattam and Adichchanallur are better known, sites in Ramnad,[5] urn-burials at Amaravati[6] in District Guntur, Andhra Pradesh, funerary urns near Pondicherry,[7] sites in the Nilgiri District,[8] in the Pudukkottai[9] area of the Tiruchchirappalli District and in the Coimbatore District, urn-burials in Malabar,[10] particularly in Wynaad,[11] and urns at Jiwarji[12] in the Hyderabad area of Andhra Pradesh. Apart from the sites mentioned above, urn-burials have been observed, earlier at a large number of sites like Korkai, Kayal,[13] Kalugumalai, Vasudevanallur and Karivalamvandanallur[14] in District Tirunelveli; Dadampatti and Paravai[15] in District Madurai; besides the Travancore and Cochin parts of Kerala.

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[1]B. K. Thapar, 'Maski 1954: A chalcolithic site of the southern Deccan', *Ancient India*, no. 13 (1957), p. 32.

[2]K. R. Srinivasan, 'The megalithic burials and urn-fields of south India in the light of Tamil literature and tradition', *Ancient India*, no. 2 (1946), pp. 9–16.

[3]*Indian Archaeology 1961–62—A Review*, p. 3 and *Ibid., 1962–63*, p. 2.

[4]A. Rea, *op. cit.*; *Annual Report Archaeological Survey of Madras and Coorg 1903–04*, pp. 23 ff.; and 'Ancient remains at Kaniyampundi', *Annual Report Archaeological Department, Southern Circle*, Madras, 1910–11, pp. 10–13.

[5]C. R. Krishnamacharlu, 'Some prehistoric sites in the Ramnad and Tinnevelly Districts', *Annual Report Archaeological Survey of India 1936–37*, p. 67; and A. Rea, *op. cit.* (1888 and 1904).

[6]A. Rea, 'Excavations at Amaravati', *Annual Report Archaeological Survey of India 1908–1909* (Calcutta, 1912), pp. 88–91.

[7]Numa Laffite, 'A note on certain signs inscribed on pottery found in ancient funeral urns in south India', *Indian Antiquary*, LX (1931), pp. 137–38.

[8]J. W. Breeks, *An account of the primitive tribes and monuments of the Nilgiris* (London, 1837), pp. 72–110.

[9]K. R. Srinivasan, *Report of the working of the State Museum Pudukkottai*, Fasli 1348 (1938–39), pp. 3–5 and *ibid.*, Fasli 1352 (1941–42), pp. 6–7.

[10]W. Logan, *Malabar*, I (Madras, 1887), pp. 179–183.

[11]L. A. Cammiade, 'Urn-Burials in Wyanaad, Southern India', *Man*, Vol. XXX (1930), Art. no. 135.

[12]M. Taylor, 'Descriptions of cairns, cromblechs, Kistvaens, and other Celtic and Scythian monuments in Dekhan', *Transactions of the Royal Irish Academy*, Vol. XXIV, part iii (1862), pp. 329–362.

[13]R. Caldwell, 'Explorations at Korkai and Kayal', *Indian Antiquary*, VI (1877), pp. 80–83.

[14]L. A. Cammiade, 'Observations upon Ancient Sites in the Neighbourhood of Kalugumalai, Madras Presidency, *Man*, Vol. XXX (Oct. 1930), No. 136, pp. 187–189.

[15]A. Rea, *op. cit.* (1888).

The systematic exploration of megalithic monuments during 1944–48, concentratedly in the Chingleput District and the peripheral region, the Pudukottai area and the Cochin part of Kerala brought to light a large number of urn-burial sites. A complete list of such sites found in Chingleput, North Arcot and South Arcot areas together with a few sites discovered subsequently and general observations is given in the Appendix.[1]

The excavations and explorations enumerated above have thrown considerable light on the urn-burials in general and have helped to establish firmly that they belong to the megalithic-complex. It will not be out of place to mention a few facts regarding their occurrence along with the megalithic monuments.

The Chingleput District has produced a large number of urn-burials throughout its expanse. Of the thirty-one sites so far discovered, twelve occur in isolation, while the rest are intermingled with the pure megalithic monuments.[2] The co-occurrence of urn-burials and megalithic monuments and, in fact, the incorporation of the urns within the megalithic structure of the cairn-circle is illustrated graphically in the Pudukkottai region as well as in the Nilgiris.

Even the *Kudakallu*[3] group of megalithic tombs in Kerala come clearly within the category of urn-burials. These are not enclosed by a circle when alone or isolated, but when in a group or cluster they are invariably enclosed by slabs placed with an inward inclination, thus forming a bounding circle. Though a scientific excavation of such monuments has yet to be attempted, the section[4] of a cutting that was published nearly 85 years ago indicates a pit, with a ledge around it near the top, cut into the lateritic rock underground. The ledge itself is approached by a flight of steps cut into the rock and reaching up to it. The shaft is comprehensively covered on the completion of the funerary ritual and deposit of furnishings which include the placement of the urn and its lid containing the skeletal remains into the pit and of the grave goods on the ledge excavated specially for the purpose.

The picture thus presented long before the birth of stratigraphical excavation in the country strongly recalls Porkalam as well as the urn-burials in Pudukkottai, though in neither of these cases had the grave-goods any ledge to rest upon. They were, therefore, spread in a cluster around and over the urn within the pit.

In Porkalam as well as in Pudukkottai, the pit containing the urn, was finally sealed from view by a slab of stone and enclosed by a circle. The urns in Pudukkottai were covered by a cairn. Again, there were multiple urns also as in the case of the multiple *Kudakallus* in Kerala.

The urn-burials in Nilgiris,[5] too, are comparable in structure and form to those in Pudukkottai as they have the cairn-circle as well as the capstone.

The picture at Amirthamangalam is not very different, though it does not have the covering slab. The stone-circle, too, is virtually absent, though the occurrence of a

[1]Compiled from the site-cards of exploration which was begun and conducted by the late V. D. Krishnaswami. The late K. N. Puri, and M. N. Deshpande, Y. D. Sharma, B. K. Thapar, K. V. Soundara Rajan and the present author have participated in the exploration work.

[2]See Appendix.

[3]V. D. Krishnaswami, *op. cit.* (1949), p. 40; and 'Prehistoric Cochin', *Proceedings of Indian Science Congress Association*, 1947.

[4]Logan, *op. cit.* (1887), pp. 182–83, *vide* illustration (No. IX) prepared by J. Babington, whose work on the description of the Pandoo Coolies in Malabar, in *Transactions of the Literary Society of Bombay*, Vol. III (1823), pp. 32–334.

[5]Breeks, *op. cit.*

cluster of lateritic blocks around the urn would point structurally to a megalithic connexion.

The similarity of contents, the form of funerary relics and intermingling of urns with the megalithic monuments either in close proximity or in inter-mixed association would leave no room for doubt as to familial inter-connexion between the urn-burials and the other types of megalithic monuments.

It is evident from the foregoing that the stone-circles may or may not occur in association with the urn-burials. Thus, urn-burials may be divided into two classes, viz., urn-burials (i) with and (ii) without stone-circles. In the former category may be included those with prototypal circles like the ones at Amirthamangalam (above, p. 6). Circles made of diminutive stones were found at Porkalam where a stone slab covered the urn. On the other hand, Adichchanallur did not yield any circle and this feature seems to be quite common as recent explorations have revealed many an urn-burial without this megalithic appendage at a number of sites like Nanjalur, Kattumannargudi, Kumaramangalam,[1] Parearkoil, Tulukanveli,[2] Nachchiarpettaimedu,[3] Sengamedu and Erumanur[4] in District S. Arcot, Terazhandur, Kandhahi, Pittachcheri, Perumkadambalur,[5] Kilperumpallam, Manigramam, Viramethiruppu, Vanagiri, Nandanmedu,[6] Vallam, Rajendram, Sikkal and Tillayadi[7] in District Thanjavur, Samanattam, Palangunattam, Vilangudi, Paravai,[8] Thatanodaimedu, Sengulam, Vedar Puliangulam, Vilangudi, Tenur, Podumbu Sikandar Chavadi, Nagamalai Pudukkottai,[9] Sangapadai, Tangalcheri, Madipannur, Sivarakkottai, Kottaimedu, Amattiapatti, Periakattalai, Vandarai, Parapatti, Tirumanikkam, T. Kallupatti, Velambur,[10] Chennampatti, Kuraiyur, Krisalkalampatti, Pudur and Kottaipatti[11] in District Madurai, Kottampatti, Kottaimedu, Kattuputtur and Puttur[12] in District Tiruchchirappalli, Mohanur[13] in District Salem, Perianayakanpalaiyam,[14] Dharamapuri and Pollachi[15] taluks and Karumandichellipalaiyam[16] in District Coimbatore, in Tamilnadu.

Those outside this area include Chengamenad[17] in District Ernakulam, Kerala, and Someshwara Hill and Gaudageri[18] area in District Dharwar, Mysore, besides the sites at Gajendragad, Kalakaleswara, Rajur and Unachageri[19] in the same District. Urn-burials even outside the southern peninsula are known, namely, those in the Munda

[1] *Indian Archaeology 1955-56— A Review*, p. 27.
[2] *Ibid.*, *1958-59*, p. 71.
[3] *Ibid.*, *1960-61*, p. 63.
[4] *Ibid.*, *1961-62*, p. 26.
[5] *Ibid.*, *1955-56*, p. 27.
[6] *Ibid.*, *1961-62*, p. 27.
[7] *Ibid.*, *1964-65*, pp. 23-24.
[8] *Ibid.*, *1956-57*, p. 80.
[9] *Ibid.*, *1957-58*, p. 38.
[10] *Ibid.*, *1958-59*, p. 32.
[11] *Ibid.*, *1960-61*, p. 19.
[12] *Ibid.*, *1963-64*, p. 20.
[13] *Ibid.*, *1961-62*, p. 26.
[14] *Ibid.*, *1957-58*, p. 38.
[15] *Ibid.*, *1960-61*, p. 18.
[16] *Ibid.*, *1961-62*, p. 26.
[17] *Ibid.*, *1963-64*, p. 13.
[18] *Ibid.*, *1963-64*, p. 26.
[19] *Ibid.*, *1964-65*, p. 31.



A. *General view of the urn field.* *See p. 4.*



B. *AMRM-2: outline of the pit.* *See p. 5.*

To face p. 10.



A. *AMRM-2: contents of exposed urn A. See p. 13.*



B. *AMRM-3: damaged urn exposed in the quarry-pits. See p. 15.*

To face pl. III



A. *AMRM-2: Urn B.* *See p. 13.*



B. *AMRM-2: contents of Urn B.* *See p. 13.*



A. *AMRM-2: a view of Urn D, from south-east. See p. 14.*



B. *AMRM-2: top view of Urn D. See p. 14.*

To face p. 11.

country[1] in the Ranchi District or the Chhota Nagpur plateau. Recent work in the Singbhum[2] District has shown the incorporation of the urn within the dolmenoid-cist in this area.

As stated above (p. 5), the urn-burial revealed mostly the evidence of post-excarnation fragmentary burial but the evidence of complete skeleton is not wanting. A. Rea has adverted to the circumstances of full skeletons inside urns in the Tirunelveli District.[3] K. R. Srinivasan had adduced similar evidence from the urn-burials in Pudukkottai.[4] Meadows Taylor had observed two full skeletons inside a cairn in Jiwarji[5] more than a hundred years ago. Likewise, the evidence of two skeletons entombed in a dolmenoid-cist, made of slabs of stone, has come from Sulur[6] in District Coimbatore. Though these are exceptional cases, a common streak of identical human behaviour runs through them all and thus threads them together on yet another ground.

The find of burnt bones[7] inside an urn, covered by a slab, in the Nilgiri is reported by J. W. Breeks in 1837. If, correctly assessed, it agrees with the evidence of the Asur burials in the Munda country.[8] The practice of prior burning and a secondary burial is also reported from elsewhere in the Krishna District.

In this context it would appear that the theory propounded by A. Aiyappan[9] that the urn-burials are characteristic of the southern Districts of Tamilnadu, cists of Godavary and Krishna valleys and pottery sarcophagi of the intermediate region is very nearly true.

An interesting, though palpably incredible, theory about the rôle of the urn-burials was stated by M. J. Walhouse[10] and it deserves but a passing mention. He believed that there was a practice in India of sacrificing infant girls, and it was these helpless victims who were buried in the urns, and the arms and weapons found inside constituted the very instruments with which they were slaughtered.

The urns at Amirthamangalam occur on a sterile lateritic highground, overlooking low-lying arable lands all round, surrounded by a large number of irrigation-tanks. This feature indicates the solicitude of the urn-burial people for the inviolate character of the prosperity-bestowing agricultural land. The location of the burials themselves on a position where they stand out apart and serve as a guardian angel for the prosperity of

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[1]J. C. Coggin-Brown, 'Note on cinerary urns found in the Munda country,' *Journal of the Bihar and Orissa Research Society*, Vol. I (1915) p. 131 and S. C. Roy, 'A note on some Remains of the Ancient Asurs in the Ranchi District', *ibid.*, pp. 229–53.

[2]*Indian Archaeology 1961–62—A Review*, p. 9.

[3]A Rea, 'Prehistoric Antiquities in Tinnevelly', *Annual Report Archaeological Survey of India*, 1902–03, pp. 118–19.

[4]K. R. Srinivasan *op. cit.* (1938–39) and (1940–41).

[5]M. Taylor, 'Ancient Remains in the village of Jiwarji near Ferozabad on the Bhima', *Journal of the Bombay Branch of the Royal Asiatic Society*, Vol. II (1851), Part 2, pp. 179–96.

[6]H. C. Beck, 'Notes on Sundry Asiatic Beads,' II. Beads from Megalithic Tombs and Midden in Sulur Taluk and Neighbouring Districts, *Man*, XXX (Oct. 1930), Art. No. 134, p. 172.

[7]Breeks, *op. cit.*

[8]Coggin-Brown, *op. cit.*; S. C. Roy, *op. cit.* A tomb in the Munda country attributed by belief and tradition to the Asurs was opened by Dr. S. C. Ray recently and the urns were seen to contain calcined bones. Information from Dr. S. C. Ray and Shri A. K. Sharma.

[9]A. Aiyappan, 'The megalithic culture of Southern India', Presidential Address, Anthropology and Archaeology Section, *Indian Science Congress*, XXXII Session 1945.

[10]M. J. Walhouse, 'Some vestiges of girl sacrifices, jar burials and contracted interments in India and East' *Journal of the Anthropological Institute*, London, Vol. II (1882), pp. 415–23.

the community, even as the bare dolmenoid-cist at Uttiramerur in District Chingleput, to which this function was interpretatively attributed by Krishnaswami, indicates this.

The skeletal remains from Amirthamangalam indicate the post-excarnation multiple interment in fragmentary form as in other types of the megaliths, though the 'tower of silence' where the body might have been kept exposed in the first instance has yet to be found out here.

A few interesting features about ancient injuries or diseases have been noticed in the skeletal remains here. The evidence of a femur found in one of the urns showing malunion after a fracture (pl. XVC) is interesting from the palaeo-medical point of view (p. 24). There is, likewise, evidence of caries in the teeth.

The practice of offering grave-goods, presumably to provide for the journey to or for use in the life beyond, was in vogue here as in the megaliths. The absence or rather paucity of iron from the urns as also of other antiquities are of course striking. Iron was not indeed absent from the site, nor was it in a primitive stage; indeed, the broken fragment of a sword with a mid-rib (pls. XIIIB and XIVA), recalling the sophistication attained at Adichchanallur was found at the bottom of a partially-exposed and damaged urn in the rain-gully cutting into the lateritic subsoil.

Pottery formed the bulk of grave-goods here. In shape, fabric, and technique the vessels conform to the usual pots met with in the megalithic tombs. The urns themselves were, of course, hand-made as is usually the case everywhere in the megalithic complex. The oval and elongated shaped urns with their pointed bottom (described as pedunculated) simulate, as it were, the womb in appearance, and the entombment of the skeletal remains may, in this context, be symbolic of the return of the dead to Mother Earth. Yet, it has to be borne in mind that the bottom is not always sharply pointed or pedunculated but often disc-shaped in the form of a solid heel, 4 in.–11 in. (0·101 m.–0·279 m.) in diameter.

In consideration of the cultural characteristics, in general, presented by the urn-burials, they would have to be included in the megalithic-complex, despite the absence of the lithic enclosure or cover.

6. THE CUTTINGS

A. General

Excavation was carried out at four sites which are respectively called (i) AMRM (B)-1, (ii) AMRM-2, (iii) AMRM-3 and (iv) AMRM(B)-3.

As the two natural dunes in site AMRM (B)-1 proved unhelpful (see p. 3), the five partially-exposed urns in AMRM-2 were taken up first to lay them bare fully and, last of all, encouraged by the finds in AMRM-2, the barrow-like area in AMRM(B)-3 was taken up for stratigraphic excavation.

B. AMRM (B)-1

The site at AMRM (B)-1, where barrows were expected, did not yield any pit or urn. The negative evidence was, however, useful in that it indicated that all that looked like a barrow need not actually be a tomb (fig. 1).

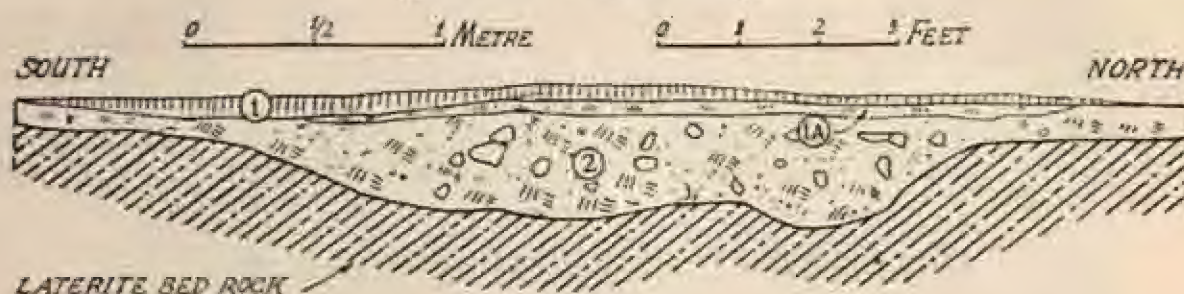


Fig. 1

C. AMRM-2

AMRM-2 has yielded five urns called, respectively Urns A, B, C, D and E. The actual work of excavation on the principal finds is described below.

(i) *Urn A*

The exposed urn in the gravel-quarry was examined for its contents. The gravel section, however, did not run over it, and, hence, nothing could be made out regarding its working levels. It was an already-damaged urn without a lid and, on clearance, the filling inside the pit was seen to have contained two pots, one intact and the other damaged (pl. II A). The intact pot was a jar of Black-and-red Ware with a large globular body, a tall neck, and carinated profile and a beaded rim. The sherds of the other pot, also of Black-and-red Ware, suggested the shape of a dish. The hand-made urn, with a pedunculated bottom, did not yield any skeletal remains.

(ii) *Urn B*

It was a damaged urn (pl. III A) having a battered lid with a rolled rim. The urn was inside a pit cut into the latertic gravel. Wide at the top, the pit narrowed as it went down. The urn did not contain any bones but the grave goods in the filling of the pit consisted of three pots, all damaged, two of which were in Black-and-red Ware and the third in red ware. While the shapes of the Black-and-red Ware vessels were indeterminable, the red ware one was a globular jar with a blunt carination at the waist, a tall straight neck and an externally-beaded rim. The urn itself contained nothing apart from two red ware pots (pl. III B) of which one was a usual globular jar and the other an unguent bottle with pressed sides and a blunted base.

(iii) *Urn C*

It was much disturbed with only the lower portion available and further unaccompanied by any grave goods.

(iv) *Urn D*

It was comparatively an intact specimen and the most representative of the urns found exposed in the gravel-pits of the site (pls. IVA, VA and VB). The large urn of oval shape was laid, as usual, into a pit cut into the gravel reaching right down to the bedrock (fig. 2). In it was placed an assemblage of selected skeletal remains (pls. VIA and XIVB) consisting of three tibia, one fibula, three humeri, one radius, one ulna, a femur, twelve teeth including molars, pre-molars and incisors, bits of phalanges, ribs, fragments of vertebrae and a skull. The loose teeth found near the skull might have fallen loose from the maxilla.

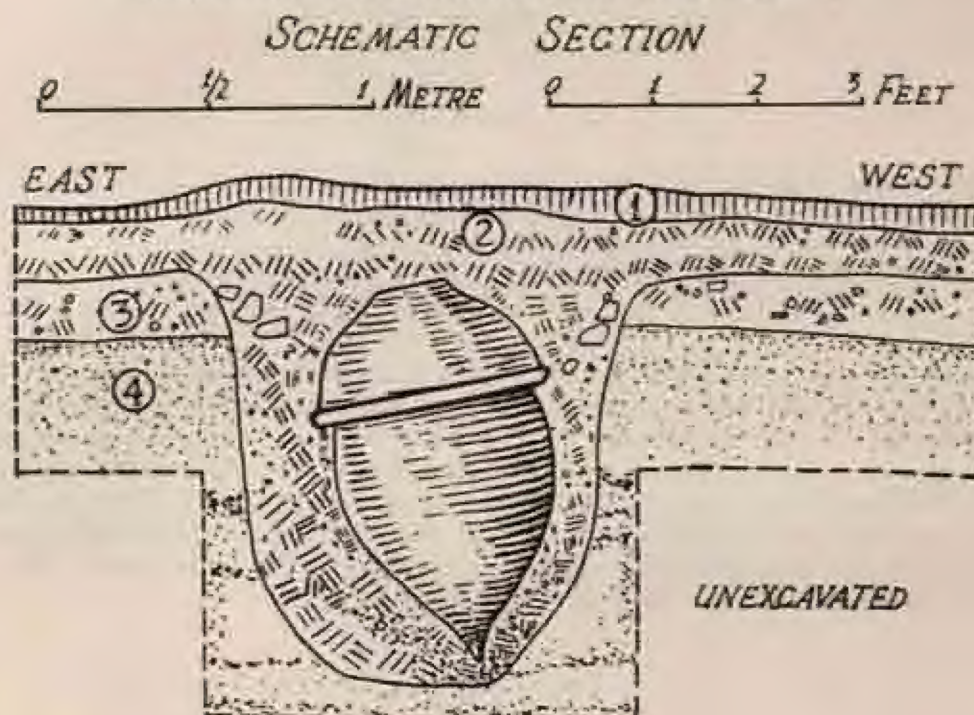


Fig. 2

The funerary furniture consisted of two pots in black ware, both of them bowls with a wide and narrow mouth and faceted or flattened rim with external grooves below the rim.

The urn was filled in with earth after the grave furniture, consisting of the fragmentary post-excarnation skeletal remains, and bowls, had been placed inside and finally covered with a basin-shaped flared out lid, the last mostly intact though cracked and damaged. Seven small pots of black ware and one of red ware, all very fragile, being of poor fabric, were placed partly over the fringe of the lid and partly into the filling of the pit beyond the edge of the rim, all huddled into one cluster.

A few small lateritic stones were placed outside the pit at its fringe (pl. IVB), suggesting the idea of the bounding stone-circle of megaliths.

This burial-urn presents a fairly representative picture of the process of interment in urns at the site, the only significant omission being the absence of iron objects.



A. *AMRM-2: Urn D, after removing the lid.* *See p. 14.*



B. *AMRM-2: Urn D, in relation to the section.* *See p. 14.*



A. *AMRM-2: contents of Urn D. See p. 14.*



B. *AMRM-2: Urn E, in situ. See p. 15.*

(v) *Urn E*

It was an oval-shaped urn with a pedunculated bottom placed into a pit cut into the gravel, found partially exposed in the gravel section with a damaged lid (pl. VIB). The upper part of the urn, too, was damaged (pl. VIIA) and extraneous objects like blocks of stone, bits of the urn and its lid and earth were thrown inside. The skeletal remains were confined to a few fragments; the pots placed inside as grave-goods were also damaged with several fragments missing. Obviously, there was some disturbance, possibly shortly after the interment, which would account for the havoc. The tilted position of the urn would point towards the same conclusion, though the tilt could have taken place during the actual process of interment.

A large number of small pots in the shape of bowls, ring-stands, dishes, small vessels, a pyriform jar, etc., were found in a jumble in the filling of the pit (pl. VIII) a little below the rim of the lid, indicating that they were placed after the placement of the lid, but before the pit was filled up completely.

The miniature size of the pots is significant and may suggest a ritualistic, though non-functional, role.

The pit was finally filled up with earth, and, in all probability, a tumulus or low mound was formed over the interment. However, as there is no trace at all of any tumulus-like formation, its absence may be provisionally attributed to erosion which appears largely to have denuded the site of its upper features. While as many as twenty-six different pots could be counted, it was also observed that the red ware predominated over the Black-and-red and black wares.

D. AMRM-3

A single urn, with its upper parts damaged, together with the battered remnants of a lid was lying partially exposed in the quarry-pits (pl. IIB) by the roadside, a little to the west of the road itself. The urn had a heeled, not pedunculated, bottom (pls. VIIB) which is 4 in. (0·102 m.) in diameter. The upper parts of the section were not available, and, hence, a reconstruction of the complete process of interment was not possible, though it could not have been much different from the general practice adopted here.

The reclaimed grave goods consisted of two pots, one of which was a bowl in Black-and-red Ware and the other a straight-necked globular vessel perhaps in black ware, besides fragmentary skeletal remains of an adult and an infant, thus clearly indicative of the practice of dual or, for that matter, multiple burial in consonance with the megalithic tradition.

The skeletal remains consisted of seven fragments of ribs, long bones, two femurs, metatarsals and metacarpals, phalanges, detached fragments of six vertebrae and a damaged mandible with seven teeth in articulation belonging to an adult, besides a skull and twelve deciduous teeth belonging apparently to an infant, in addition to twenty-four teeth in articulation.

E. AMRM(B)-3

(i) *General*

A large area, measuring 21 ft. × 21 ft. (6·4 × 6·4 m.), marked by hardened circular clayey or grassy patches was next taken up for excavation with a view to recovering undisturbed specimens of urn-interment at the site on the western side of the road.

The excavations revealed interlinked pits, containing five urns, cut into the brownish lateritic gravel. The urns were called respectively A, B, C, D and E. These, too, were not free from disturbance, though, on the whole, Urn D is almost intact but for a slight tilt.

(ii) *Urn A*

It was an oval urn (pls. IXA and B) of rather small size, found tilted to one side, with a comparatively small mouth, a rolled rim and a pedunculated bottom. A few fragments of the broken lid were still sticking to the upper part of the urn, indicating that a disturbance might have taken place soon after the completion of funerary rites which resulted in the damaged condition of the lid described above as well as the tilt of the urn.

Inside the urn were found several fragments of a pot of red ware treated with a slip and decorated obliquely with incised lines. A few sherds of the black ware were also available in the filling. Filled originally to the brim with grave-goods and earth, it was apparently crushed by the overlying weight of the filling of the pit and the tumulus that appears to have covered the urn as well as by the pressure of the filling inside. Human bones began to appear at the belly level below the broken sherds, which may suggest that the skeletal remains were placed prior to the introduction of the accompanying grave-goods.

The fragmentary and uncalcined skeletal remains comprised the shaft of a femur with broken ends, bits of long and other bones, and deciduous molar and a fragment of an infant skull.

(iii) *Urn B*

It was also tilted towards the east and much damaged. The lid was also broken, perhaps due to the weight of the overlying filling. Beyond the reach of the lid, in the filling of the pit, was a globular pot, with a straight neck and beaded rim, in red ware. The urn contained three small pots (pl. XA) in black ware, of which two were globular jars of identical shape, while the third was a bowl with featureless rim and two broad and shallow grooves outside below the rim. It had no skeletal remains.

(iv) *Urn C*

It was much damaged (pl. XB) and did not contain any pots. However, there were three fragments of long bones inside.

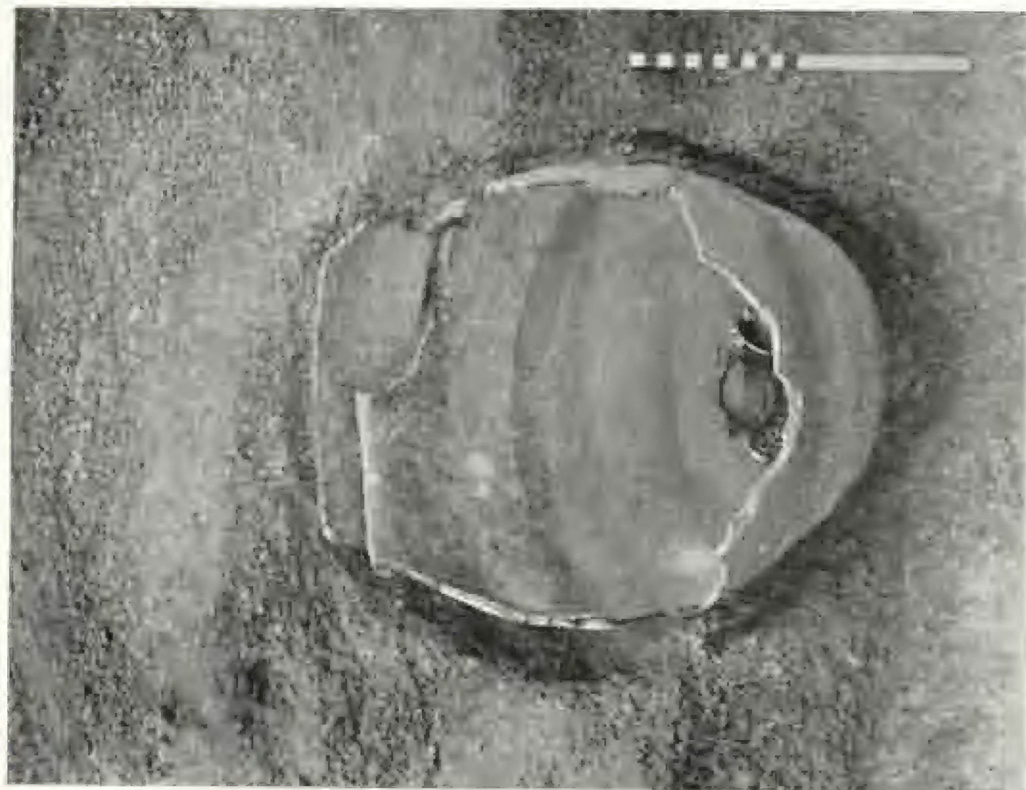
(v) *Urn D*

It was a small, round and squat pot covered with a lid having a flattened base (pl. XIA). The urn (pl. XIIA) itself was much damaged perhaps due to pressure. A few sherds of both red ware and Black-and-red Ware were found at the fringes of the pot into the filling, but beyond the reach of the lid.

The edge of the pit was lined with blocks of exotic granite, two of which are dressed, suggesting the remains of a stone-circle (pl. XIB).

The urn contains a single flask or jar, with a straight neck, a beaded rim, a blunt carination at the waist and a flattish base. It is further marked by two grooves at the waist and two near the base. The shoulder bears a graffito-mark consisting of six lines converging towards a point near the neck.

PLATE VII



B. *AMRM-3: urn in section showing the damaged lid and contents. See p. 15.*



A. *AMRM-2: Urn E, with the lid damaged, top view. See p. 15.*



AMRM-2: Urn E and the pottery furnishings inside the pit. *See p. 15.*

To face pl. IX.



A. *AMRM (B)-3: view of Urns A and B inside pit, from south-west.* *See p. 16.*



B. *AMRM (B)-3: top view of Urns A and B.* *See p. 16.*

To face pl. VIII.



A. *AMRM (B)-3: contents of Urn B.* *See p. 16.*



B. *AMRM (B)-3: Urn C, after removal of earth filling.* *See p. 16.*

To face pl. XI



A. *AMRM (B)-3: Urn D, with lid on. See p. 16.*



B. *AMRM (B)-3: Urn D, inside the pit and section. See p. 16.*

To face pl. X



A. *AMRM (B)-3: Urn D, with the lid removed.* *See p. 16.*



B. *AMRM (B)-3: Urn E, inside the pit.* *See p. 17.*



A. *AMRM (B)-3: close view of Urn E. See p. 17.*



B. *AMRM: iron sword found in a disturbed urn. See p. 12.*

To face pl. XII



A. *AMRM: iron sword found in a disturbed urn.* *See p. 12.*



B. *AMRM-2: contents inside Urn D.* *See pp. 14 and 21.*

The skeletal and cranial remains were rather ill-preserved and comprised the front portions of a skull, the nasal bridge, eye-sockets, the forehead and temples and the full set of sixteen teeth in articulation with the lower mandible, much disintegrated. The long bones included two femurs, fragments of tibia, one fibula, two clavicles and portions of a scapula and of the occipital region of the skull.

(vi) *Urn E*

It was a large but damaged urn (pls. XIIB and XIIIA), covered with a battered lid lying a little to the north-west of Urn D. There were two disintegrated pots in red ware in the filling over the urn.

It contained the fragment of a long bone, probably the portion of a femur, and a few sherds of the black ware.

7. POTTERY

By K. S. Ramachandran

A. General

The pottery from Amirthamangalam can be classified into three wares, namely, the Black-and-red Ware, the black ware and the red ware. It is invariably wheel-turned except for the burial-urns in red ware and their lids. All the pots are of medium fabric. The number of pots is extremely meagre in contrast to those in cists or sarcophagi enclosed by bounding stone-circles. The funerary pottery occurs both outside and inside the urns. A distinctive feature is the occurrence of miniature vessels, mostly in the red ware, but also limitedly in the black ware. The Black-and-red and black wares are treated with a slip and are burnished. The slip on the red ware, if there had been any, has entirely disappeared.

Only one example of decorated pot was noticed and the design consisted of slanting incised lines on the shoulder and immediately below the waist of a black jar.

Grafitto-marks have been found on two pots and are described elsewhere.

The types in the Black-and-red Ware consist of bowls and carinated jars, those in the black ware being bowls—miniature, normal and deep—and jars—carinated and miniature. The red ware is represented by urns having a deep and elongated body—and a heavily-rolled rim, with or without a pointed (pedunculated) base, miniature bowls, miniature jars, lids or dishes, normal jars with vertical neck and beaded rim and large lids with heavily rolled rims to cover the mouths of the burial-urns.

B. The types

Fig. 3

The following select types are illustrated:

Type 1. Miniature shallow bowl of red ware with inturned featureless rim (recurve), a shallow but broad depression below the body and a sagger base. Medium fabric. (AMRM-2, Urn E).

Type 2. A miniature bowl of black ware with two grooves on the vertical sides, an everted rim and a sagger base. Medium fabric. AMRM (B)-3, Urn B.

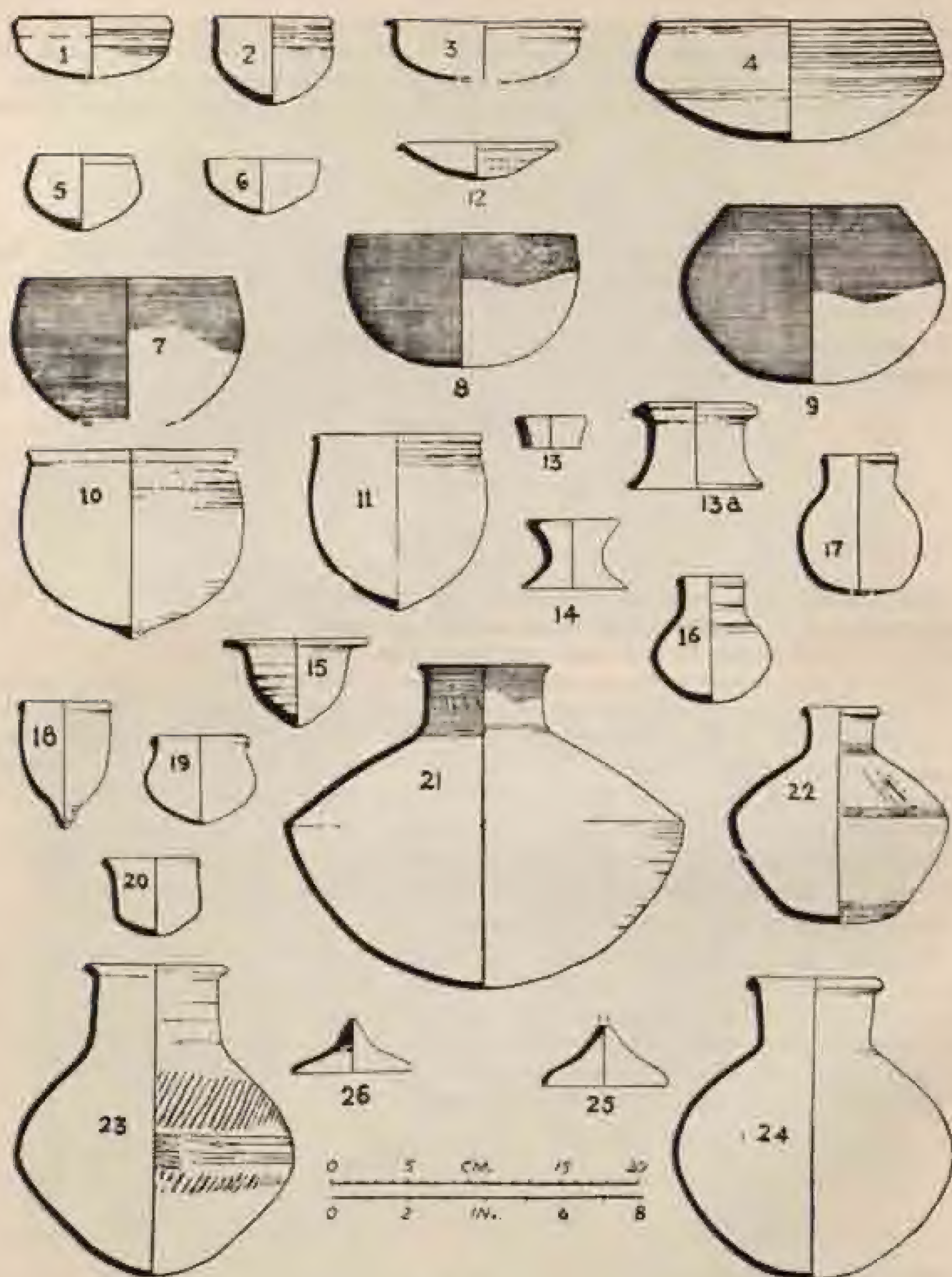

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Fig 3

Type 3. Miniature dish or shallow bowl of red ware with out-turned sharpened rim, a depression below the rim and a sagger base. AMRM-2, Urn E.

Type 4. Burnished dish or shallow bowl of black ware with inwardly inclined sides having five equally-spaced grooves, an internally bevelled rim and flattish base. Medium fabric. AMRM-2, Urn D.

Type 5. Miniature bowl of red ware with inturned sides, a thin featureless rim, a bulging waist and a sagger base. AMRM-2, Urn E.

Type 6. Miniature bowl of red ware with a featureless rim, vertical sides and a sagger base. Medium fabric. AMRM-2, Urn E.

Type 7. Bowl of Black-and-red Ware with a thick featureless rim, slightly bulging waist and a sagger base. Medium fabric. AMRM-2, Urn E.

Type 8. A bowl of Black-and-red Ware with straight sides, an internally chamfered rim and a sagger base. Medium fabric, AMRM-2, Urn A. (Cf. fig. 24, T. 81; fig. 19, C3b from Brahmagiri, *Ancient India,* no. 4; fig. 14, B(1), from Maski, *Ancient India* no. 13—all variants.)

Type 9. Deep bowl of Black-and-red Ware with an inwardly-inclined shoulder, a featureless rim, a bulging waist and a sagger base. Medium fabric. AMRM-2, Urn E.

Type 10. Burnished deep bowl of black ware with a thin out-turned rim, vertical sides containing five evenly spaced grooves ending under the rim, a bulging waist and a tapering body with the base ending in a prominent nipple-like tip. Medium fabric. AMRM-2, Urn D. (A variant of this (with worn-out slip), with seven grooves, has been found in burials at Kilpauk by M. D. Raghavan.)

Type 11. Burnished deep bowl of black ware with an everted rim, vertical sides, a bulge at the waist and a tapering body with the base ending in a nipple-like tip. Three evenly-spaced grooves under the rim are found. Medium fabric. AMRM-2, Urn D.

Type 12. Flattish dish or lid of red ware with thickened and externally bevelled rim. Medium fabric. AMRM-2, Urn E. (Cf. fig. 14, P14b from Brahmagiri, *Ancient India,* no. 4, fig. 23, no. 28 in red ware from Maski; and pl. XXXIII, no. 14 from Perumbair, *Annual Report Archaeological Survey of India* (abbreviated hearafter as *ARASI*), *1908–09*—all variants).

Type 13. Miniature ring-stand of black ware with a thick featureles out-flaring rim at top and a flat rim at the narrow base.

Type 13a. Ring-stand of red ware with an externally bevelled and thickened rim on the upper side and a featureless rim at the broad base. Medium fabric. AMRM-2, Urn D.

Type 14. Ring-stand of red ware with a flat internally indented (projected) rim on the narrow upper side and a thin featureless rim at the broad base. Medium fabric. AMRM-2, Urn E.

Type 15. Miniature conical bowl or lid of red ware with flat flanged rim. Three broad depressions, apparently due to the pressure exerted by the finger while being turned on wheel, is seen clearly on the inner side. (Surface, cf. pl. XXV, no. 6 from Perumbair, *ARASI 1908–09* and also pl. LVI, no. 14, a variant from Tirunelveli, *ARASI 1903–04,* both black).

Type 16. Miniature jar (worn-out slip) of black ware with a clubbed rim, a vertical neck with two incipient raised grooves on the shoulder, a bluntly-carinated waist and sagger base. Medium fabric. AMRM-3, Urn A.

Type 17. Miniature globular-jar (slip worn-out) of black ware with a beaded rim, a short vertical neck and a sagger base. Medium fabric. AMRM (B)-3, Urn A.

Type 18. Miniature conical vessel or cup of red ware with a clubbed rim and a pedunculated bottom. Medium fabric. AMRM-2, Urn E.

Type 19. Miniature globular vessel of red ware with an externally beaded rim, a bulging waist and a rounded base. Medium fabric. AMRM, surface.

Type 20. Miniature (worn out and misshapen) deep bowl with a thin out-turned rim, tall vertical sides, a bluntly-carinated waist and a sagger base. Medium fabric AMRM-2, Urn B.

Type 21. A jar of Black-and-red Ware, with a clubbed (out-turned) rim, a vertical neck, a tapering shoulder, a sharply-carinated waist and a sagger base. An incipient depression below the rim and a raised ridge at the junction with the shoulder can be seen. Bears post-firing graffito marks on the inner side of the neck comprising five almost evenly-spaced, slanting lines. Medium fabric. AMRM-3. (Cf. pl. XXXVI, nos. 1 and 5 from Perumbair, *ARASI 1908–09,* both black ware).

Type 22. Burnished (worn-out) small jar with a vertical neck, an externally beaded rim, a slanting shoulder, a bluntly-carinated waist and a body tapering and ending in a flat base. Two small grooves on the waist and three above the base are to be seen. On the shoulder are to be found post-firing graffito-marks comprising seven lines converging to a point at the base of the neck. Medium fabric. AMRM (B)-3, Urn D.

Type 23. Burnished black jar with an out-turned rim, a vertical neck (with thin incipient ridges), a tapering shoulder, a bulging waist with three evenly-spaced grooves or depression and rounded base. A band of slanting linear incised decoration is to be seen on the shoulder and two bands immediately below the carination. Medium fabric. AMRM-2, Urn B.

Type 24. Globular jar of red ware (slip worn-out) with a beaded rim and a vertical neck with a raised ridge and two faint lines at the junction with the shoulder. Medium fabric AMRM-2, Urn A.

Type 25. Miniature funnel-shaped lid of red ware with a featureless incurved rim and a pinched finial. Medium fabric. AMRM-2, Urn E.

Type 26. Similar to above with a sharpened rim. Medium fabric. AMRM-2, Urn E.

C. Graffiti

The designs are simple and are confined to an arrangement of multiple lines.

Type 1.—A set of five equally-spaced shorter lines incised slantingly on the inner side of a Black-and-red Ware jar (*Type 21*).

Type 2.—A set of six lines, incised on the shoulder of a black ware jar, converging to a point at its junction with the neck (*Type 22*).

8. PRELIMINARY REPORT ON THE SKELETAL AND CRANIAL REMAINS FROM AMIRTHAMANGALAM

By H. K. Bose

A. Introductory[1]

Of the four sites excavated at Amirthamangalam in 1955, the site at AMRM (B)-1 did not yield any relics at all. Of the rest, sites AMRM-2 and AMRM(B)-3 had each five urns, while the site AMRM-3 had a single urn to account for. Not all the urns were found to contain skeletal remains, which were confined to Urns D and E in AMRM-2, to Urns A, C, D and E and also to the single urn in AMRM-3. Thus, the skeletal remains were confined to seven out of the eleven urns exposed in the excavations. The absence of bones from the damaged urns can be easily understood. The absence of bones in Urn B of AMRM(B)-3, however, is to be attributed to a deliberate action or to an accident, if not to subsequent damage by spoliation. It is also observed that animal bones were not associated with these urn-burials.

The bones are fragmentary, disarticulate, uncalcined and of more than one individual in at least three cases, namely, in Urn D of AMRM-2, Urn A of AMRM(B)-3, and in the single urn of AMRM-3. This would indicate that the urn-burial people did not burn the dead, but exposed them somewhere and later collected the skeletal remains—not all the bones of the dead but all that could be found readily after the flesh had decomposed or had been eaten away by the carrion eating birds or beasts. They then put them inside the urns already fitted into their pits, along with a gift of suitable grave goods.

[1]Introductory paragraphs written by the present author.



A. *AMRM-2: skeletal remains in Urn D.* *See p. 21.*



B. *AMRM-2: contents of Urn E.* *See p. 23.*



C. *AMRM-2: fragment of a femur showing the fracture.* *See pp. 12 and 24.*



A. *AMRM (B)-3: skeletal remains inside Urn C.* *See p. 24.*



B. *AMRM (B)-3: cranial remains inside Urn D.* *See p. 24.*

To face pl. XVII



A. *AMRM (B)-3: contents of Urn E. See p. 25.*



B. *AMRM-3: contents inside the urn. See p. 25.*

To face pl. XVI.



A. *AMRM-3: skeletal remains inside the urn. See p. 25.*



B. *AMRM-3: cranial remains inside the urn. See p. 26.*

This practice contrasts with the evidence of the so-called Asur burials in the Munda country in the Ranchi District, Bihar, wherein calcined and fragmentary bones have been found interred. Such a practice has been observed in the Nilgiris.

The practice of post-excarnation, fragmentary and multiple burial of skeletal remains met with in the urn-burials at Amirthamangalam conforms to that normally observed in the megalithic tombs of south India.

B. AMRM-2

(i) *Urn D*

General.—Urn D is situated towards the northern end of the group known as AMRM-2. It had a damaged lid.

The bones (pl. XIVB) found in this urn are disarticulated and uncalcined as found elsewhere. The interment is also fragmentary. They were placed inside the urn in a jumbled fashion and were huddled together in a heap.

The skull.—A very much disintegrated skull, surviving mostly in a mould of earth, with an occasional thin bony surface sticking to it, was found on the southern extremity. The skull lay on its parietal (left?) occipital touching the western side of the urn. The maxillary portion had entirely disintegrated. A number of loose teeth, found to the east and lying at the bottom of the urn, might probably belong to the maxillary portions.

Long bones.—Touching the pelvic bone was a tibia with both ends broken. Contacting the proximal end of this tibia was the other tibia whose distal end diverged. These two were found with their proximal ends towards south-west. In between these two were humeri and two broken parts of two fibulae.

At the extreme end towards the north, touching the urn, were two femurs with their ends broken and damaged. They happen to have been placed almost vertically. Here also the proximal ends were placed pointing towards the bottom of the urn. Orientation was S.W.—N.E.

About fifteen long bones (pl. XVA) were found huddled together mostly in the centre of the urn and slightly towards the north. A few were also found on the southern side, one almost touching the side of the urn at a distance.

Other bones.—In between the long bones on the extreme north and the cluster of bones in the centre, parts of other smaller and long bones were found. On top of the two long bones in the centre and touching the tibia on the north were fragments of pelvic bones.

Lying across and roughly N.—S. and partly resting on the pelvic bone and touching the urn on the southern end was a shaft of an ulna measuring 8" (0·203 m.) in length. Both ends were broken. It was in a fairly good state of preservation and probably belonged to a young adult. Between the black bowl touching the urn in the north and the skull and overlying the tibia was a broken humerus, 10" (0·254 m.) in length. This might also belong to a young adult.

Lying together with the two tibiae were two shafts of two fibulae measuring 4" (0·102 m.) and 8¾" (0·221 m.). The humerus was on the southern side, and in between the tibia on the south and the other humerus on the north was the shaft of a radius with its ends broken. It measures 5" (0·127 m.) in length.

Mandible.—At the very bottom were found three broken pieces of a mandible and a few broken pieces of ribs. The lower jaw had three teeth, probably molars in articulation. Another bit of the mandible with one molar and a premolar was found sticking to the western side of the urn, and this was completely hidden by the skull.

Bones inside a black bowl.—Inside the black bowl on the north were found pieces of vertebrae and ribs. These probably were pushed into the bowl by the pressure of the earth-filling.

A number of teeth were found scattered inside the urn on the southern half. These probably have fallen off from the disintegrated upper jaw lying above. The teeth are nine in number: three molars (fragments with cusps in two, the third showing signs of caries), two pre-molars (the cusps in both are good, suggesting recent eruption), three incisors (slightly eroded) and an undeveloped incisor (?).

General conclusions.—Though the bones exhibited signs of disintegration, specially at the proximal and distal ends, and were invariably damaged, yet it may safely be said that these were in a better state of preservation than the bones found in other urns. These probably belonged to two adult individuals.

List of bones.—The following is the list of bones recovered from Urn D.

1. (a) Two humeri: four broken parts—distal and proximal ends broken—of an adult.
   (b) One humerus: broken distal end of a young adult (second individual?).
2. Two femurs: broken into two parts at the middle of the shaft; distal and proximal parts broken. Belong to a sturdy individual.
   One femur: broken into two parts at the middle of the shaft, belongs to a young individual (second individual).
   One femur: broken bits of a second femur(?) of a young individual (?).
3. One tibia: broken into two parts at the middle of the shaft; distal and proximal parts broken.
   One tibia: belongs to a sturdy individual. A small broken end of the shaft of the same sturdy individual.
   One tibia: three broken parts of the shaft of a young individual (?).
4. Two fibulae: four pieces of the shafts of two fibulae of an adult.
   Two fibulae: six pieces of the shaft of fibulae of a young individual (?).
5. One ulna: one broken shaft of an ulna of a young adult (?).
6. One radius: two broken parts of a radius of a young adult (?).
7. Pelvic bones: several broken parts.
8. Teeth: (a) three molars, cusp in one worn out; (b) one pre-molar; (c) two incisors; (d) several broken parts of molars and other teeth—roots of all the molars broken excepting one; and (e) one deciduous molar (another individual ?).
9. One mandible: one piece of an adult.
   (a) Left half of a mandible with three molars in their respective sockets.
   (b) One broken part of a mandible with one pre-molar and one molar in their respective sockets.
   (c) Right ramus of a mandible with both the condyle and coronoid processes broken (probably of a second young individual male).
10. Maxilla: one broken part of a maxilla with two molars in the sockets, of an adult.
11. Miscellaneous: broken parts of ribs, phalanges, vertebrae and other unidentifiable bits of smaller bones.

(ii) *Urn E*

Only a few broken bits of bones (pl. XV B) were found deposited at the bottom of this urn constituting broken bits of ribs, fibula, scapula, clavicle and other long bones of an adult.

C. AMRM (B)-3

(i) *Urn A*

General.—Urn A is the smallest of the three urns found in a pit to the west of the road. The urn was placed rather vertically (a slight, though negligible, tilt towards east was perceivable). Although the urn was found in a good shape, signs of decay were apparent; many fissures running down from top to the very bottom were observed. Straggling remains of what might have been once a lid were also observed.

Inside the urn, several pieces of what once constituted a red ware earthen pot were found. It had a red slip and slanting incised decorations. A few fragments of black ware were also found, associated with them.

Bones began to appear at a depth of 3′ 7½″ (1·104 m.), just below these broken potsherds. They lay at about the belly-level of the urn. Like all other urns this was also filled up to the brim; curiously enough, the rim-portion of the red pot was not available. The breakage of the urn might be attributed to the pressure of the overlying earth-filling inside the urn. This urn also had a pedunculated bottom.

The skeletal and cranial vestiges contained in this urn might conveniently be divided into three groups, viz., one lying on the eastern side, the middle one lying at the bottom of the urn and the last at the north-west. The bones were in an extremely disintegrated condition beyond redemption, becoming powdery by the mere touch of the fingers and had formed into lumps with the earth-filling.

The jumble on the east consisted of the broken bits of shorter bones (probably three pieces of phalanges) and some pieces of longer bones.

On the south-eastern side of the lump sticking to side below the bones at the top was a fragment of a skull piece. It was about ⅓″ (0·008 m.) in thickness and was in an advanced state of disintegration.

The group of fragmentary bones at the bottom in a lump consisted probably of the internal basilar surface of the occipital portion of the skull which survived only in a small thin sheet. On the southern side touching the urn was a piece of long bone. Underneath this cluster was a broken shaft of a tibia, 3½″ (0·088 m.) long.

The long bones on the north west.—On the north-west is a long bone with its major axis N.E.–S.W. The proximal and distal ends of this were not found, and only a portion of the middle region was obtained. This forms the shaft of a femur measuring about 7½″ (0·190 m.) length. At the south-west end lying on top of it at an angle of about 60° was a piece of another long bone in fragmentary condition. Another piece of a long bone in this cluster was a bit of a fibula.

Only one molar was found sticking to the side of the urn on the south-west. It is a deciduous molar, the root of which was found damaged.

General remarks.—Judging from the meagre remnants of the long and other bones it appears that they did not inter all the bones of a single individual in the urn. Excepting for the presence of one deciduous tooth, all the other bones were that of a young adult.

Deformity in a femur.—Distinct sign of a longitudinal fracture of about 3¼" (0·082 m.) long, running almost parallel to the *Linea aspera* to a distance of about ¼" (0·006 m.) from it, on the posterior side of the shaft of the femur and its ultimate union with the body could be seen clearly. On the anterior side, the fracture was about 2½" (0·063 m.) long and had united completely leaving a faint mark at the line of union. On the medial side, it was two inches (0·050 m.) round and the line of fracture with its ultimate malunion (pl. XVC) with the body could be observed very clearly. It is a case of malunion of the parts of the same bone, through overlapping of parts during life, at the line of fracture. The subject must have received an injury on the affected part through probably some accident, which even after union left a deformity by way of a lateral bulge.

(ii) *Urn C*

Only three broken shafts (pl. XVIA) of about 4" (0·102 m.) in length were seen deposited near the bottom of the urn. They were extremely fragmentary and had completely disintegrated.

(iii) *Urn D*

General.—At the very bottom of this urn a much disintegrated skull (pl. XVI B) surviving in the facial portion and parts of the parietals was found. The entire vault of the skull including the occipital had wholly disintegrated. No portion of this end was found. The facial portion was survived by the supercilliary arches, the nasal bone and to some extent the zygomatics. Lower portion of the face and the maxilla could be discerned. Similarly, the lower portion of the orbits was not complete, its lower margin having been eaten away. The lower margin of the nasal aperture along with the maxilla was also eaten away and showed a wider gap through disintegration.

Lower jaw.—The lower jaw was resting in front of the skull touching the urn on the east, the right condyle of the mandible having gone into the right eye cavity. The other ramus with its condyle and coronoid processes was broken and was lying a little away in a slanting position to the north. The left ramus got detached from the body at the junction, through disintegration. The body of the lower jaw beginning from the right pre-molar up to the end at the extreme left molar had entirely disintegrated from the alveolar margin to the rest of the body touching the urn. All the sixteen teeth were present and apparently lay in position, without the body of the mandible which had completely disintegrated.

All the teeth showed distinct signs of wear suggesting advanced age. The right side of the mandible, which was intact up to the first pre-molar, was comparatively in a fair state of preservation excepting the edges touching the urn. The condyle and coronoid processes on the right side were intact.

The teeth were in articulation almost showing the curve. The alignment on the left had shifted.

Towards the west, touching the bottom of the urn, was a lump which probably is a portion of the left side of the occipital bone joining together with the left parietal. Adjoining this and placed a little to the south was a fragment of a shaft of a fibula going underneath the skull, besides (i) a portion of a rib, (ii) a portion of a long bone, (iii) a portion of vertebrae, and (iv) fragments of unidentified bones.

List of bones.—The following is the list of bones found in Urn D.

1. Disintegrated skull.
2. Disintegrated mandible with a full set of teeth.
3. Two femurs with three broken shafts of an adult.
4. Two broken shafts of a tibia.
5. Six broken bits of fibulae.
6. Three broken bits of clavicles.
7. One disintegrated scapula.
8. Four bits of phalanges.
9. Ribs; one broken bit sticking into the cavity of the skull.
10. Vertebrae; one broken bit into the cavity of the skull.

(iv) *Urn E*

Only a single broken bit of a long bone (pl. XVII A) was found which survived in a thin sheet laid over an earthen core which got completely disintegrated.

D. AMRM–3

General.—Bones found in this urn were disarticulated, uncalcined, fragmentary and were found in a very bad state of disintegration. They had been placed at the bottom of the urn. An intact Black-and-red Ware bowl and a broken pot were also found on the top of this heap of skeletal and cranial remains (Pl. XVII B). Due to some accident, the straight-necked pot had broken, and its fragments were found strewn in all possible places—on top as well as below the heap of bones. Some of the bones were found lodged into the broken bits of this pot probably on account of the pressure exerted at the time of the accident and by the overlying earth-filling. The urn was filled up with earth up to a height of 2′ 3″ (0·686 m.)—about three-fourths of its height. Like other urns excavated in this area, this urn was also filled up to the brim and covered with a lid, broken portions of which were found in the section. But the later disturbances here by quarrymen or the inquisitive public reduced the level of the filling. A few laterite blocks were also found into the filling of the urn.

General remarks on the bones.—There seems to be no particular arrangement about the placing of these bones (pl. XVIII A) in a specified space or in a formulate fashion. They were found jumbled together on all sides all over the area at the bottom of the urn. In fact, the long bones and other fragments were found in a cluster.

The skeletal and cranial remains were in a much disintegrated, worn-out and broken condition.

Bones of more than one individual have been interred in this urn, and this is confirmed by the presence of skull pieces of an infant and a dozen deciduous teeth consisting of molars, pre-molars and incisors. The mandible at the bottom-most part of the urn with seven teeth in position (six molars and one pre-molar) belonged, without any doubt, to an adult. The nature and structure of the long bones, vertebrae, metacarpals, metatarsals and phalanges confirm that they belonged to a grown-up man.

Judging from the dentition in the lower jaw it may be concluded that the second individual was a fully grown-up adult whose age may be placed somewhere beyond thirty years.

The skull.—Some of the disarticulated bones of the skull, particularly occipital and parietals, were found in the centre of the heap near the Black-and-red Ware bowl. Two long bones at the top and one at the bottom and fragments of long bones had circumscribed the cranial remains.

The disarticulated skull-bones lay on its occipital region. Possibly these small skull pieces belonged to an infant and, therefore, justify the presence of the deciduous teeth, twelve in number consisting of molars and incisors, deposited at the bottom of the urn as also lodged in between the space occupied by long and other bones.

Long bones.—Immediately beneath the skull pieces, too much disintegrated (in the central region) long bones, about 14" (0·356 m.) long, were found astride the lower jaw, which was found placed at the very bottom of the urn. These long bones probably were femurs. They were oriented N.E.–S.W.

Other skeletal remains.—Fragments of ribs, (seven) long bones, phalanges, metacarpals, metatarsals, etc., were found scattered all over.

Nearly seventeen (excluding those in articulation in the mandible) teeth—molars, pre-molars, canine, incisors, etc., were found strewn in all conceivable places. Some of these were deciduous which might point to the possibility of bones of more than one individual being interred in one urn. Portions of vertebrae were also found, two on the east of the long bones, two on the west, two beneath the long bones, one at the north-east and the other at the south-west ends. One canine was found inside the cavity of the atlas.

Mandible.—The lower jaw (pl. XVIII B) was practically placed at the bottom of the jar and, like other bones, was broken and in a very bad state of disintegration. It was an adult jaw with a somewhat prominent chin. The two ascending rami were broken and got much worn out at their outer edges. All the molars had erupted. On the left side, the second pre-molar and all the three molars were found in their respective sockets (four teeth). The cusps of the first molar showed signs of erosion, the second molar had a deep groove, covering almost the entire length and breadth showing signs of caries. The third molar showed signs of having been erupted recently with very little signs of the corrosion of the cusps. On the right side, three molars were found placed nearby but out of their sockets. Although the second molar was there in its socket it had been driven deep inside, probably due to the weight of the other bones placed over it. The femurs already mentioned were found placed over this mandible. Altogether twelve teeth consisting of molars, pre-molars, canine, and incisors were found here. All this would show that the individual was a fully grown adult.

[*Received on the 1st April 1966.—Ed.*]

APPENDIX

LIST OF URN-BURIAL SITES EXPLORED

Serial No.	Site	Lat. & Long.	Taluk	Description	Remarks
1	2	3	4	5	6
			A. CHINGLEPUT DISTRICT (Tamilnadu)		
1.	Amirthamangalam	13° 24′ 15″N 80° 3′ 12″E	Ponneri	Urn-burials cover an area of 27·87 sq. m. marked by barrows.	Damaged by quarrying. (The excavations at this site form the subject of the present publication.)
2.	Attantangal	13° 12′ 30″ N 80° 10′ 0″ E	—do—	An extensive urn-burial site, marked by barrows rising from 15 to 30 cm. above the surrounding ground level and distinguished by a scatter of chips of granite.	A virgin field. No other megalithic type occurs here.
3.	Chellapillaiyarkuppam	13° 17′ 38″ N 80° 9′ 20″ E	—do—	Broken fragments of urns and sarcophagi found on the surface. A mound about 365·76 m. in diameter.	No other megalithic type occurs here.
4.	Nallur	13° 13′ N 80° 9′ 20″ E	—do—	An extensive barrow site marked by somewhat raised mounds with a scatter of granite chips. Fragments of urns and sarcophagi are found in the quarry pits.	Neither stone-circles nor any other type of megalithic monuments are reported from the site.
5.	Perumbedu	13° 21′ 25″ N 80° 14′ 30″ E	—do—	Black-and-red Ware and other megalithic ware sherds strewn on the surface.	No other megalithic type occurs here.
6.	Siruvadu	13° 23′ 45″ N 79° 59′ 45″ E	—do—	A few urns are exposed on the surface.	Cairns enclosed in circles of lateritic stones dressed on the

APPENDIX—(*Contd.*)

Serial No.	Site	Lat. & Long.	Taluk	Description	Remarks
1	2	3	4	5	6
					exterior is the common type of associated megalithic monuments.
7.	Kallumedu	13° 12′ 30″ N 79° 54′ 15″ E	Tiruvallur (formerly spelt Trivellore)	A number of broken urns were found in quarry pits on a lateritic ridge, with indications of barrows, with a scatter of granite chips. Fragments of sarcophagi were also found.	Some pieces of slabs of granite (in a lateritic area) may probably have served as capstones over pits containing urn-burials, though the point remains yet to be examined.
8.	Palavakkam	13° 19′ 30″ N 79° 54′ 15″ E	—do—	An urn-burial site; some urns have been exposed by quarrying.	There are no superficial indications as at Attantangal.
9.	Sengarai (Thandumedu and Kallumedu)	13° 19′ 50″ N 79° 59′ 30″ E	—do—	Mound strewn with granite chips. It is a probable urn-burial site as at Attantangal.	Villagers have spoken of a granitic slab, probably a capstone of the urn-burial.
10.	Guindy (Madras, Premises of the King Institute).	13° 1′ N 80° 13′ E	Saidapet	Buried pots (urns?) were reported by Lt. Col. King, former Sanitary Commissioner, Madras.	A. Rea who had inspected the site was of the opinion that it was probably a deserted village. Investigation of the site has not revealed any other remains, and it is, therefore, a doubtful site.
11.	Mettupalaiyam (Tetteri)	13° 8′ 40″ N 80° 13′ 30″ E	—do—	A barrow-site with remains of urns and sarcophagi and Black-and-red Ware pottery.	The barrows have all been rifled. No other megalithic type occurs here. The urns have a discoid footed base.
12.	Pattur	13° 9′ N 80° 9′ E	—do—	The common type of monument on the site is the cairn surrounded by a stone-circle, though many of them appear to have been denuded of the bounding circle stones. The cairns are large in size, and have been seen to	V. D. Krishnaswami, who explored the site, considers that the cairns with multiple urn-burials served probably as family graveyards.

				contain pyrifom urns, besides terracotta sarcophagi. In some cases with sarcophagi there were no bounding circles. The circle-stones, of laterite, were chiselled on the exterior.	
13.	Trisulam	12° 88' N 80° 10' E	—do—	The southern slope of the hill to the east of the village is strewn with fragments of legged sarcophagi and urns. There are a few undefined barrows near the water-line of the tank near the village. The Madras Museum excavated an area in 1944 and exposed an urn and sarcophagi. One sarcophagus was oriented north-south.	Information about King's remarks from V. D. Krishnaswami. Also see *ARASI 1903-04*, p. 45.
14.	Pulal	13° 9' 40" N 80° 12' 30" E	—do—	It is, apparently, a habitation site with bits of urn-like pots bearing a raised decorative band of rope-pattern below the rim, and sherds of the Black-and-red Ware usually met with in the megaliths.	A palaeolith, an ovate, was picked up on the surface.
15.	Chikkarayapuram	13° 1' 20" N 80° 6' 10" E	Sriperumbudur	An extensive graveyard marked by a large number of cairns, some of which are defined by mutilated and hence discontinuous stone-circles. These enclosed both sarcophagi and urn-burials often in close juxtaposition. The urns had pointed bottom or a pedunculated base and were covered with a lid.	The type of the urn-burial is the same as at Amirthamangalam.
16.	Malaipattu	12° 55' 30" N 80° 0' 30" E	—do—	Stone-circles enclosing dolmenoid-cists and cairns, respectively, and urns with a knobbed bottom (pyriform ?) without the bounding circle lying exposed on the stones of a hillock characterize the site. Sarcophagi are also reported from the neighbourhood (Sirumathur).	The pyriform urns occur about 45 cm. below ground level.
17.	Vadamangalam	12° 57' 45" N 79° 54' 15" E	—do—	It is a huge megalithic site with cairn-circles, and circles enclosing dolmenoid-cists. Terracotta sarcophagi were noted inside dolmenoid	The orientation of the sarcophagi is usually east-west. The site is ideal for excavation.

Serial No.	Site	Lat. & Long.	Taluk	Description	Remarks
1	2	3	4	5	6
				cists. Pyriform urns were found, apparently, without the bounding circle about 30 cm. below ground level.	
18.	Kalattur-Puduppakkam	12° 37′ 45″ N 79° 58′ 30″ E	Chinglepur	Broken urns are seen exposed on the surface on a site which also has dolmenoid-cists, some with capstone flush with the cairn and cairn-circles.	
19.	Kumili-Ottivakkam	12° 47′ 40″ N 80° 7′ 20″ E	—do—	The megalithic site is characterized mainly by dolmenoid-cists and cairns over the hill and slopes and urns in the erosion gullies on the slopes of the hills.	The urns are apparently not surrounded by circles, but occur in juxtaposition with the megalithic monuments.
20.	Manamai	12° 34′ 30″ N 80° 9′ 40″ E	—do—	Cairn-circles and urns within stone-circle enclosures occur here.	The site is ruined by quarrying.
21.	Nandivaram	12° 50′ 30″ N 80° 4′ 20″ E	—do—	Essentially it is a site with cairn-circles and stone-circles enclosing dolmenoid-cists. Cairns have revealed remains of sarcophagi as well as fragments of upper parts of urns.	
22.	Nellikuppam-Vembedu	12° 44′ 30″ N 80° 8′ 30″ E	—do—	Remains of circles with scattered fragments of urns and sarcophagi have been found here.	A few pieces of urn were found on the surface.
23.	Padur	12° 48′ 20″ N 80° 13′ 40″ E		Cairns and dolmenoid-cists occur here. The cairns entomb multiple urns together with stray sarcophagi.	The co-occurrence of the sarcophagus and urns is also to be seen at Pottur in Ponneri Taluk of the district.
24.	Reddikuppam	12° 41′ 45″ N 80° 3′ 45″ E	—do—	Pieces of smashed urns without any enclosure occur together with cairn and dolmenoid-cist circles.	The funerary monuments are on the slopes of the hillock.
25.	Sempakkam-Kottamalai	12° 42′ 30″ N 80° 7′ 0″ E	—do—	Cairns, dolmenoid-cists, both enclosed by circles and urn-burials exposed inside the cairns, are the types.	

26.	Tirupporur	12° 43′ 30″ N 80° 11′ 30″ E	—do—	A huge megalithic site extending all over slopes of the hill, having cairn-circles, and circles enclosing dolmenoid-cists and urn-burials without circles.	
27.	Vandalur Hill	12° 54′ N 80° 5′ 40″ E	—do—	A site with cairn-circles and circles enclosing dolmenoid-cists occur here. Dolmenoid-cists sometimes enclose terracotta legged sarcophagi. Fragments of urns have been found on the surface.	The site has been much damaged by the construction of the railway track that cuts across burial ground.
28.	Amandankaranai	12° 20′ N 79° 56′ E	Madurantakam	Broken remnants of four urns were found on a sloping high-ground away from the megalithic site near the village characterized by the cairn-circles.	The average diameter of the ruined urns at their belly level is 40 cm.
29.	Malaivaiyavur (Mampattu)	12° 35′ 45″ N 79° 58′ 30″ E	—do—	The megalithic monuments occur around the hillock near Malaivaiyavur and comprise dolmenoid-cists often with a capstone flush with the cairns while urns occur in erosion gullies to the east of the hill. Pieces of sarcophagi are also strewn on the surface.	The average diameter of the urns at their belly level is 76 cm.
30.	Sanur-Ariayapakkam	12° 34′ N 79° 55′ E	—do—	It is an extensive site containing cairn-circles, dolmenoid-cists and cairns with a capstone flush with the cairn surrounded by circles while pieces of urns and sarcophagi are found exposed in quarry pits.	This site was excavated by Shri K. V. Soundara rajan and the present author in 1950 and 1952, respectively. See *Ancient India*, no. 15, pp. 4–42. The urns were not tackled during the excavations mentioned above.
31.	Vilangadu	12° 20′ 30″ N 79° 55′ 45″ E	—do—	Cairns as well as dolmenoid-cists, with or without the bounding circles, the absence of which may be set down to spoliation, are plentiful. One urn was found exposed on the erosion gully. Its diameter at belly level was 33 cm.	One dolmenoid-cist was made of dressed slabs of granite.
32.	Ullavur	12° 47′ 45″ N 79° 53′ 30″ E	Kanchipuram	The site is a continuation of the megalithic burial grounds at Kundumalai in Varadapuram.	

APPENDIX—(*Contd.*)

Serial No.	Site	Lat. & Long.	Taluk	Description	Remarks
1	2	3	4	5	6
				Traces of multiple urns in eroded ground and some cairns have been observed.	
			B. NORTH ARCOT DISTRICT (TAMILNADU)		
33.	Tellur-Venkoram	12° 32′ N 79° 35′ E	Wandiwash	The site contains both dolmenoid-cists and cairns, with circles and broken urns, without any bounding circle, lying exposed on the surface.	
			C. SOUTH ARCOT DISTRICT (TAMILNADU)		
34.	Mullur	12° 8′ N 79° 21′ E	Gingee	The site contains cairn-circles and dolmenoid-cists enclosed by circles with or without dressed slabs. The cairn-circles contain terracotta sarcophagi or urn-burials.	As rare examples, slab-dolmenoid-cists enclosed by double concentric slab-circles as at Brahmagiri also occur here.
35.	Varikkal	12° 9′ N 70° 23′ 30″ E	—do—	Though the site contains simple cairn-circles and cairn-circles with the capstone flush with the cairn, a solitary sarcophagus and an urn without any bounding circle were found side by side.	
36.	Kurumankottal	12° 2′ N 79° 39′ E	Tindivanam	The site contains cairn-circles only. There is a local belief that the cairns enclose a slab covering an urn containing bones and pottery.	The local tradition has not been put to the test of the spade.
37.	Nallalam	12° 11′ 45″ N 79° 44′ 30″ E	—do—	Cairn-circles and cairn-circles enclosing dolmenoid-cists occur here within a field of urns, ranging in diameter from 60 cm. to 84 cm. at their belly level lying exposed in close proximity.	The site is a continuation of the adjoining megalithic site at Palamukkal.

38.	Palamukkal	12° 11′ 45″ N 79° 44′ 30″ E	—do—	Cairn-circles and cairn-circles enclosing dolmenoid-cists, and a few urns in close proximity, only one of which was within the enclosure of a circle but very near the edge, occur here. The urns have an average diameter of 51 cm. at their belly level.	
39.	Perambai	11° 56′ 20″ N 79° 45′ 30″ E	Villupuram	It is a sandy plateau strewn with lateritic grit containing large numbers of ribbed urns and sarcophagi.	Bones, iron and pottery were reported by L. Fauchaux of the Petite Seminaire, Pondichery.
40.	Sengamedu	12° 1′ N 79° 40′ E	Tindivanam	There is a habitation site having the form of a mound with a large number of urn-burials lying exposed and damaged in the erosion gullies in the neighbourhood. There are indications of cairn-circles in the area. The sarcophagi are absent. The urns are called in local parlance *Musumusukkaisal*, the tombs of ripe old men.	
41.	Tiruvakkarai	12° 2′ N 79° 39′ E	—do—	The site contains cairn-circles only, and goes by the local name of Kurubankottai and is believed to be the site of ancient urn-burials. Exploration has not led to the discovery of urns.	
			D. THANJAVUR DISTRICT (TAMILNADU).		
42.	Sonnaiyan-Kadu	10° 6′ N 78° 58′ E	Arantangi	The site contains only small cairn-circles of lateritic boulders probably entombing single urn-burials as at Kalasakkadu in District Tiruchchirappalli.	The point whether the cairns entomb urns has yet to be verified by excavation.
			E. TIRUCHCHIRAPPALLI DISTRICT (TAMILNADU).		
43.	Kalaskkadu	10° 22′ 20″ N 78° 50′ 30″ E	Alangudi	The site contains (i) small cairn-circles, of laterite blocks, entombing single urns covered by a gneissic slab and (ii) large cairn-circles	The type of single urn cairn-circle recalls the Porkalam variety of urn-burials. The belly diameters vary from

APPENDIX—(*Contd.*)

Serial No.	Site	Lat. & Long.	Taluk	Description	Remarks
1	2	3	4	5	6
				entombing multiple urns around a large central one, without involving the use of a capstone.	40·6 to 60·9 cm. The site was excavated by the then State Museum in 1917. The pottery tallies to an extent with the pottery from Perumbair in District Chingleput excavated by A. Rea. The name Kalasakkadu is significant as it means the (forest) ground of urn (burials). The type of single urns with capstone embedded in the cairn and the whole surrounded by a circle recalls the Kerala type represented by the urn-burial at Porkalam as well as with the *Kudaikallu* type of that region. The multiple urns again are comparable to the multiple *Kudaikallus* enclosed by a circle of orthostatic slabs in the same region. The site at Kalasakkadu is representative of the entire Pudukkottai region, where it is situated, now forming part, as a Revenue Division, of the Tiruchchirappalli District.
44.	Annavasal	10° 27' 45" N 78° 43' 30" E	Kolattur	The site has (i) cairn-circles, entombing urns, as at Kalasakkadu, (ii) cairn-circles enclosing and covering slab-cists and (iii) menhirs surrounded by circles. One of the small cairns had a	

				capstone, obviously covering an urn below.	
45.	Kadumbalur	10° 37' 30" N 78° 30' 50" E	—do—	Traces of urn-burials have been found near the large monolithic bull in the village and, considering the occurrence of megalithic monuments at Pulavayal in the vicinity, these urns can be assigned to the megalithic-complex.	
46.	Kaliyapatti	10° 38' 40" N 78° 53' 20" E	—do—	It is an extensive megalithic site containing cairn-circles, slab-cist circles, and the Kalasakkadu type of single urn-burials under cairns.	The cists were excavated by the State museum in 1937.
47.	Kiranur	10° 34' 20" N 78° 47' E	—do—	The site has been much damaged by cultivation, and the megalithic remains indicate the occurrence on the site of slab-cist circles and cairn-circles with capstone covering urn-burials of the Kalasakkadu type.	See *Manual of the Pudukkottai State*, Part II, p. 1029.
48.	Vattanakkurichi	10° 29' 50" N 78° 52' E	—do—	It is a mixed site containing slab-cist circles and cairn-circles with single urn-burials.	*Ibid.*, Vol. II, Part II, p. 1113.
49.	Melmuttukkadu	10° 30' 10" N 78° 48' E	—do—	The site has both single urn and cist-burials.	*Ibid.*, Vol. I, p. 523.
50.	Melur	10° 21' N 78° 46' 30" E	—do—	It is primarily a single urn-(with cairn) burial site within a single slab-cist burial.	
51.	Poyyamani	10° 33' N 78° 28' 30" E	—do—	The site has both cists and cairns containing single and, possibly, multiple urn-burials.	*Ibid.*, Vol. II, Part II, p. 1037.
52.	Rajagiri	10° 34' 30" N 78° 34' E	—do—	It has both urn and cist burials.	*Ibid.*, p. 1090.
53.	Sittannavasal	10° 28" N 78° 43' 30" E	—do—	It has both cist and single urn-burials.	*Ibid.*, p. 1092.
54.	Surandappatti	10° 31' N 78° 52' 10" E	—do—	It has both cist and single or multiple urns with capstone embedded in the cairn surrounded by the circle.	The capstone is either of granite or laterite. *Ibid.*, Vol. II, pp. 514, 523.

APPENDIX—(*Contd.*)

Serial No.	Site	Lat. & Long.	Taluk	Description	Remarks
1	2	3	4	5	6
55.	Tayinippattikulam	10° 31' 50" N 78° 45' 30" E		The site has both cist and urn-burials surrounded by circles of laterite stones dressed on the exterior.	The cists are invariably of granite slabs.
56.	Vagupatti	10° 26' 15" N 78° 46' 25" E		While there is no doubt about the slab-cist burials, which predominate in the site, there are cairns enclosed by lateritic stone-circles, which may contain single or multiple urn-burials.	*Ibid.*, p. 1116. The capstones within cairns occurring at Kilivanjanparai near the site are of the Kalasakkadu-type.
57.	Karai	11° 7' 30" N 78° 58' 5" E	Perambalur	It has slab-cists as well as urn-burials. Some cairns have capstones. Those with capstones are suspected to have a single burial urn and those without, multiple urns.	The urns are locally called *Mudu-makkal-tazhi*, meaning, in Tamil, old men's burial urns.
58.	Adimalam	10° 15' 20" N 78° 53' 30" E	Tirumayam	It has only cairn-circles, entombing, inferably, single urn-burials.	There seems to have been an iron-smelting centre at this site which should have utilized lateritic ores.
59.	Sivapuram	10° 20' 30" N 78° 47' 30" E	—do—	It is a cairn-circle site, containing, inferably, urn-burials.	
60.	Sokkanathappatti	10° 16' N 78° 49' 20" E	—do—	It has both slab-cist circles and cairn-circles, the latter with capstones covering single urn-burials as at Kalasakkadu. Some of the exposed urns are 50·8 cm. in diameter at the belly level.	
61.	Terimalai	10° 19' N 78° 35' E	—do—	It has both urns and cists enclosed by circles. Both single and multiple urns are expected here.	
62.	Tuttur	10° 18' 30" N 78° 33' E	—do—	Broken urns lying exposed on the pathway through the village with the evidence of slab-cist with port-hole were observed here.	

KESARAPALLE 1962

By H. Sarkar

WITH CONTRIBUTION BY M. D. KHARE

CONTENTS

1. INTRODUCTION

The large-scale excavations at Nagarjunakonda[1] in District Guntur, Andhra Pradesh, exposed relics from the Early Stone Age to the late medieval times, but the absence of cultural superimposition there made it difficult to work out a continuous sequence of cultures, specially from the neolithic to the early historical period. It was, therefore, felt that certain lacunae that existed could be bridged if some less-known sites in Guntur and Krishna Districts be examined in the light of recent experiences and with an awareness of new problems. Hence, a programme of exploring some sites in these Districts was undertaken during the year 1961–62 under the direction of the present author,[2] the main objectives being to find out:

[1] H. Sarkar and B. N. Misra, *Nagarjunakonda* (New Delhi, 1972).
[2] *Indian Archaeology 1960–61—A Review* (1961), p. 1; *1961–62* (1964), p. 1.

(i) a site where megaliths were located close to a megalithic habitation, which could not be traced at Nagarjunakonda; (ii) the chronological position of the megalithic culture in relation to the neolithic or chalcolithic assemblage of the lower Krishna basin; (iii) the chronology of the megalithic culture in relation to the Ikshvāku period (third-fourth century); and (iv) the reason for the absence of the Rouletted Ware in the historical deposits of Nagarjunakonda.

In the course of the exploration several sites were examined, but Kesarapalle, near Gannavaram, proved to be an ideal one from all the above-mentioned points of view. Consequently, two sections, KSP-1 and KSP-2, were scraped to stratify the deposit and the mound was thoroughly explored. In this task, Shri B. Vidyadhara Rao, Antiquity Assistant of the former Nagarjunakonda Excavation Project, extended his ungrudging co-operation in supervising the excavation for which the author is much thankful. Shri M.S. Mani, who was also responsible for making the drawings ready for publication, Shri K.V. Ramana Rao and Shri P. R. K. Prasad Rao, Draftsmen, prepared all the drawings, while the photographic and survey-work were done by Shri G. Lakshminarayana, Photographer, and Shri M. N. Prasada Rao, Conservation Assistant, respectively; thanks are due to all these members of the Nagarjunakonda Excavation Project. The author is also indebted to Shri M. D. Khare, now Superintending Archaeologist, for his contribution of the section on pottery. At the time of the preparation of this Report, assistance was thankfully received also from Shri N. C. Ghosh and Shri B. M. Pande, now Deputy Superintending Archaeologists.

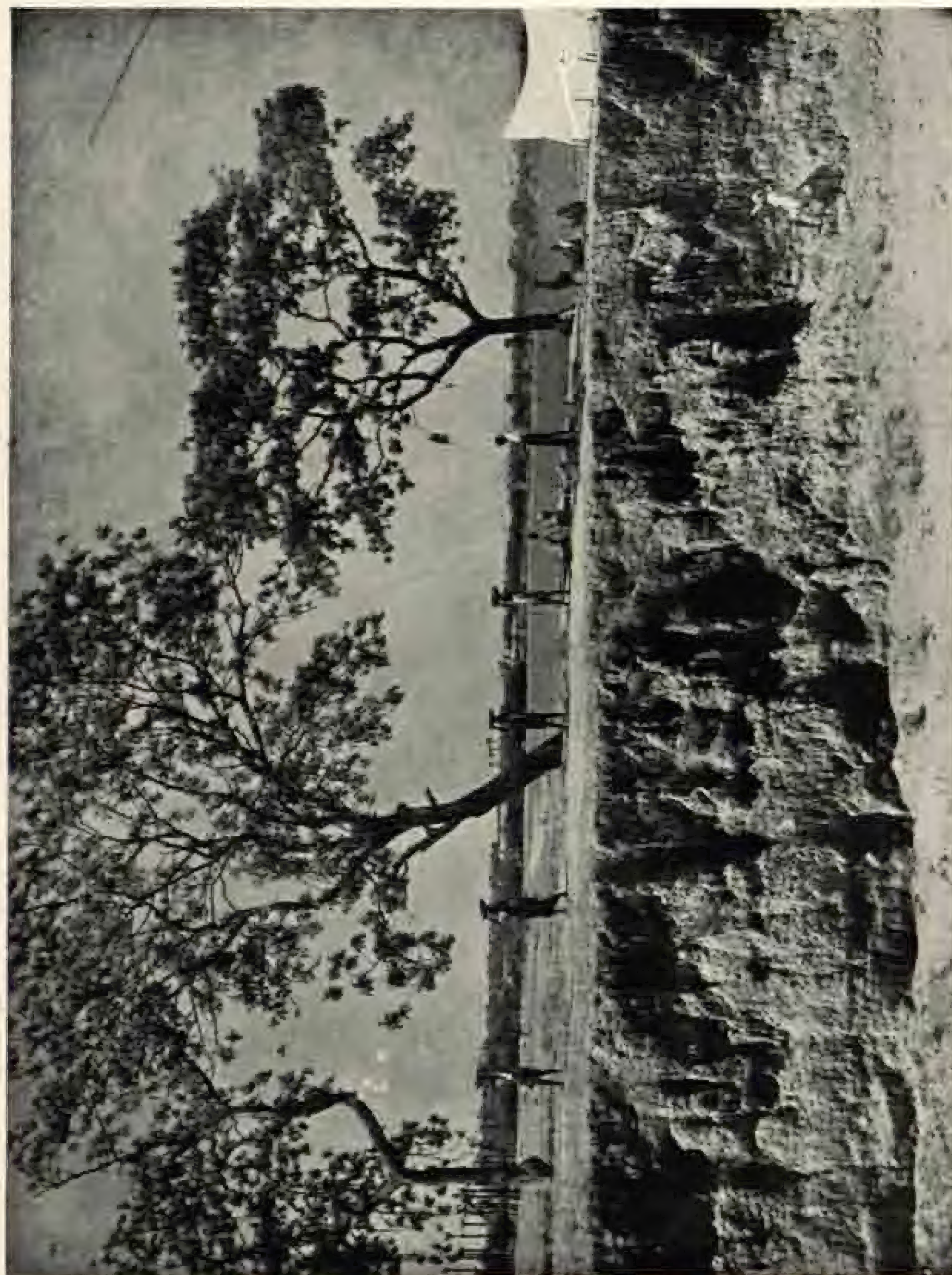
2. THE SITE AND ITS TOPOGRAPHY

Kesarapalle (16° 35' N; 81° 50'E), near Gannavaram (fig. 1), in Gannavaram Taluk of District Krishna, Andhra Pradesh, is situated about 21 km. to the east of Vijayawada, near an airport, on the Calcutta-Madras Trunk Road, which practically divides the mound into two halves. Though falling within the revenue jurisdiction of Kesarapalle, the actual mound lies close to the Gannavaram village which is only 1·6 km. to the south of Gannavaram railway station. The major part of the mound (pl. XIX) except the portion lying within the boundary of the airport was on the verge of being obliterated as a result of constant quarrying of earth (pls. XX and XXII A) locally known as *pāṭimannu*, which is considered very good for manure.

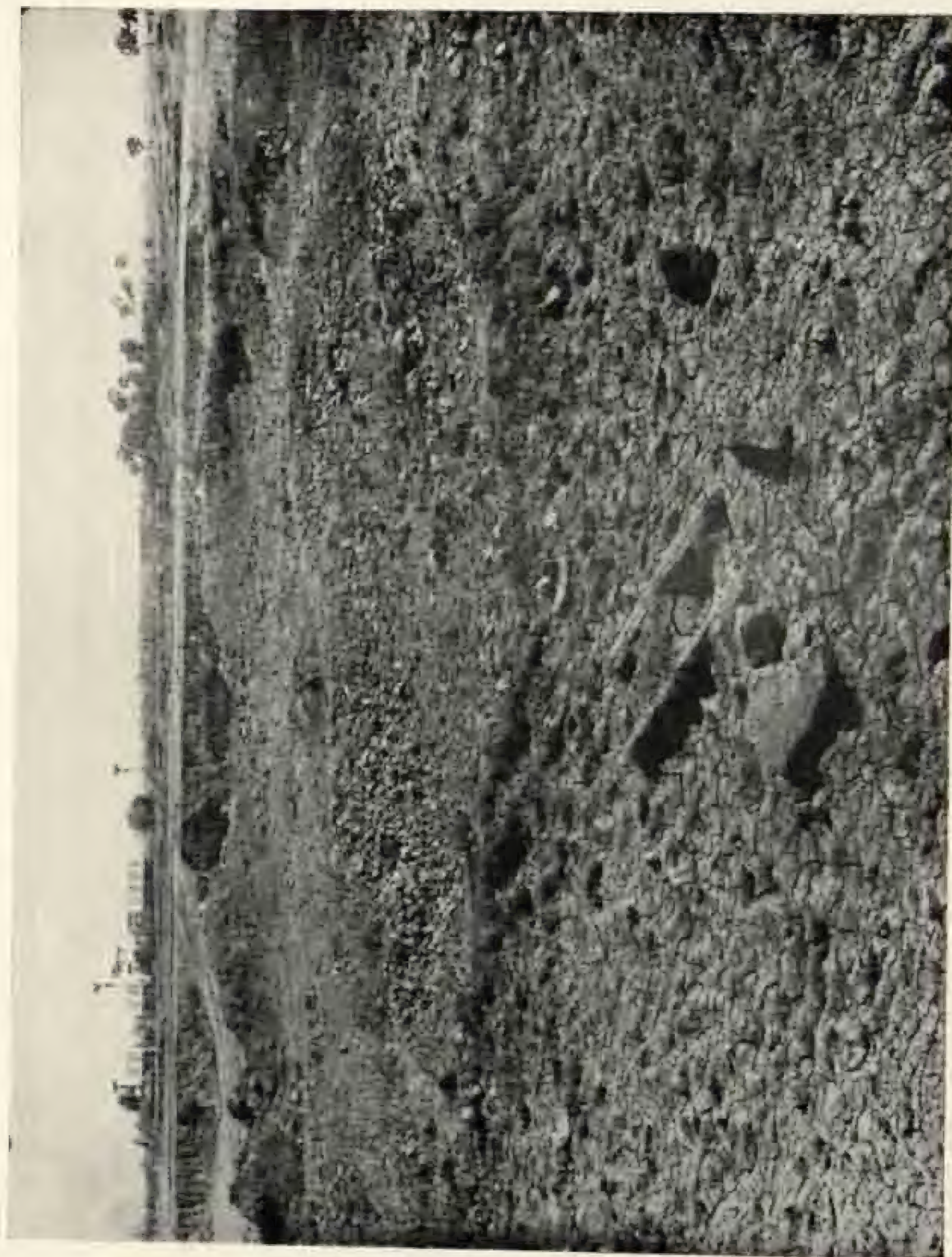
Despite the fact that Kesarapalle is known to be an ancient site to the local inhabitants and various legends have grown around its ruins, it had hardly attracted the attention of an archaeologist. Different parts of the mound have different local names—the portion falling within the jurisdiction of the airport being known as *bogam dibba* or 'harlot's mound' and the megalithic burial-site as *jangal dibba* or 'the mound of phallus'. The 'king's mound' or *raju dibba* is situated close to the Gannavaram village.

The mound is quite extensive covering an area of about 1520 × 1200 m., the height of maximum deposit being 24 m. from the surrounding areas. A nullah, at present almost dry, flows from south-east to north-west: it might have been flowing at one time into the huge tank to the north of the mound. This tank appears to be a natural formation, so common in different parts of Krishna District.

The sandy deposit at the lowest level of the excavated trench and abundance of fresh-water shells in the lower strata, besides the presence of a tank-like formation nearby, may give an idea of a marshy land that lay close to the earliest settlement of this place. It is not unlikely that in olden times the nullah had a still wider channel allowing a greater volume of water to flow and the tank was larger than what is now. On the west, as the present landscape indicates, the tank might have been extended in ancient times up to



Kesarapalle: general view of a part of the mound with cutting KSP-2. *See p. 38*



Kesarapalle: general view of megalithic area with a cist in foreground. See pp. 38 and 51

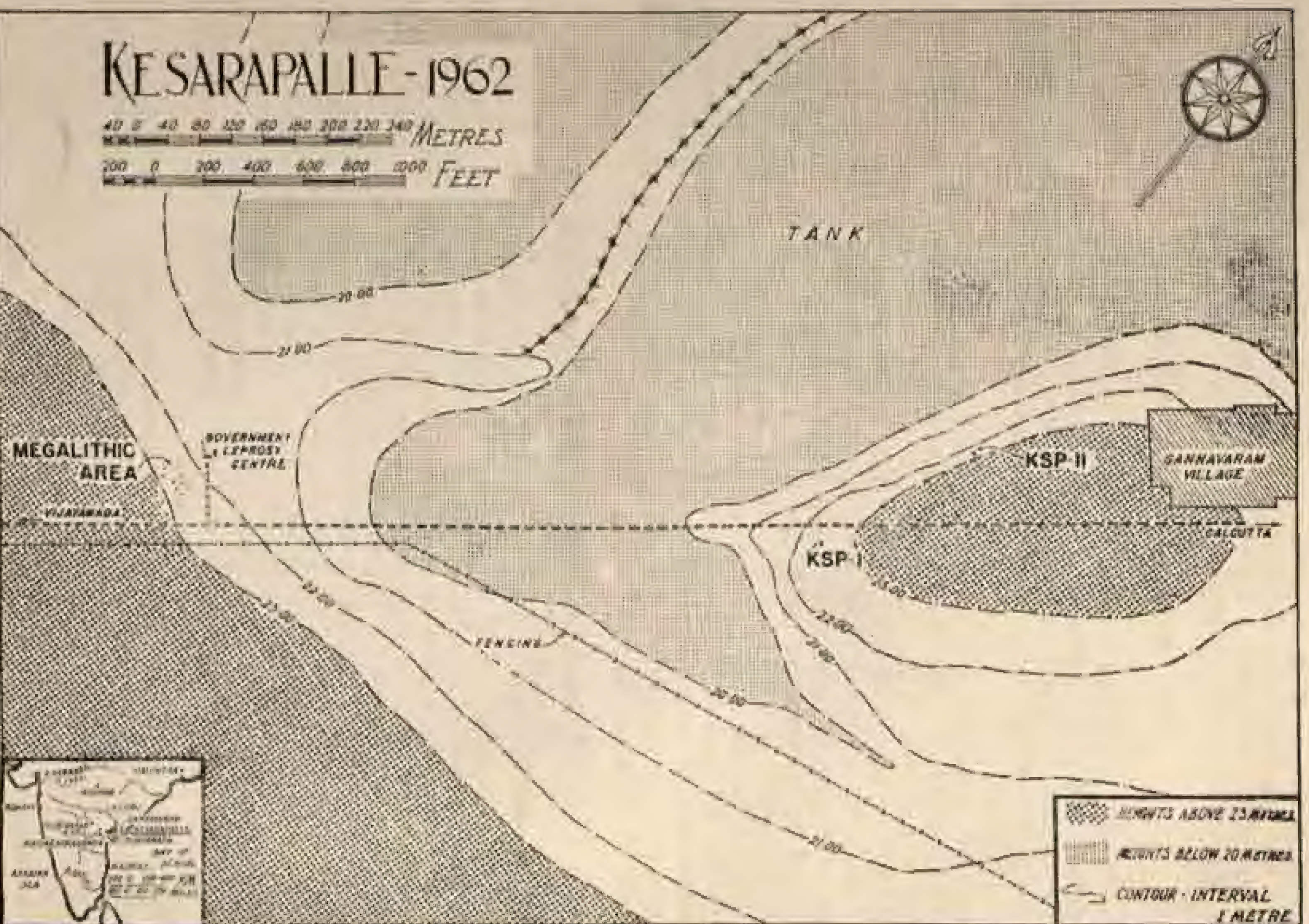

KESARAPALLE - 1962
METRES
FEET
TANK
MEGALITHIC AREA
GOVERNMENT LEPROSY CENTRE
VIJAYAWADA
KSP-I
KSP-II
GANNAVARAM VILLAGE
CALCUTTA
FENCING
HEIGHTS ABOVE 23 METRES
HEIGHTS BELOW 20 METRES
CONTOUR - INTERVAL 1 METRE

Fig. 1.

the red gravel area where all the megalithic burials were located. Moreover, the granite bed-rock in the megalithic area was found to have been superimposed by a stratum the upper horizon of which exposed a deposit of small to medium-sized water-worn pebbles (below, p. 50), the feature being suggestive of the existence of a perpetual stream of water in the vicinity.

3. SEQUENCE OF CULTURES

The sequence of cultures from the bottom to the top was as follows (figs. 2 and 3):

PERIOD I (chalcolithic culture).—It extended from the lowest level (the natural soil could not be reached) up to an average height of 2·60 m. The remains of this culture were encountered only in KSP-1, and its last phase was found interlocked with the succeeding megalithic culture.

PERIOD II (megalithic culture).—It extended to an average height of 2·40 m. or more in KSP-2 and had a wide extent at Kesarapalle. The occupational deposit of this culture was noticed in both the cuttings, but its lowest level could not be reached in KSP-2 owing to the high water-table; in KSP-1 the total height of this deposit was 1·40 m. A sherd of the Northern Black Polished Ware occurred from the upper levels of this culture.

PERIOD III (early historical).—It was divisible into two Sub-periods, III A and III B, on the basis of the occurrence of the Rouletted Ware which was infrequently met with in the earlier Sub-period in KSP-1 but was absent in the latter one. In KSP-2, Period III showed a total accumulation of 2·20 m., inclusive of the huge dump, but the distinction between the two Sub-periods here was not clear. But in other places of the mound, as the examination of exposed section revealed, the two Sub-periods could be easily distinguished.

PERIOD IV (late medieval).—This was represented in KSP-1 by a 1-m. thick deposit characterized by decadent pottery.

4. MAIN CHARACTERISTICS OF THE CULTURES

The main characteristics of the three cultures may be summarized as follows:

PERIOD I.—The pottery of the Period comprised grey or burnished grey ware and red and black wares, besides the black-and-red ware. While grey ware, either burnished or unburnished, showed the highest frequency, the black-and-red ware constitutes a subsidiary trend. The pottery was unpainted but for two small sherds—one of them depicting a design in black on greyish surface and the other white on black (below, p. 58). Other decorations consisted of simple incised or finger-tip designs confined either to grey or red ware and not on black-and-red ware; a solitary sherd of red ware bore a fragment of a graffito. Broadly speaking, the use of only five main types of vessels, viz., (i) the wide-mouthed jar used possibly for storage, (ii) the bowl, medium- or small-sized, (iii) the jar of medium size, (iv) the lid-*cum*-dish and (v) the stand, was attested. Very little could be ascertained in respect of other objects save a few pottery-discs, two bone points and a conical terracotta object of indeterminate use.

Abundance of animal bones, sometimes charred, may cast some light on the food-habits of this chalcolithic people who had perhaps special liking for the mollusc, heaps of shells of which, often in cluster, were unearthed. Of the animal bones, the bull or cow (*Bos indicus*), the buffalo (*Bos bubalis*), the goat (*Capra hircus aegagrus*), the sheep (*Ovis vignei*), the pig (*Sus cristatus*) and the spotted deer (*Axis axis*) were easily recognized; bones of birds and fish also came to light. Another noteworthy feature of this culture was the occurrence of large pits, sometimes with a diameter of 6 m.; in one instance, a pit was found cut inside


SECTION
KESARAPALLE-1962
METRES
FEET
KSP-I
SOUTH | EAST
WEST | SOUTH
NORTH
NORTH
UNEXCAVATED
LATE MEDIEVAL
EARLY HISTORICAL (MIXED)
MEGALITHIC
CHALCOLITHIC

Fig. 2.

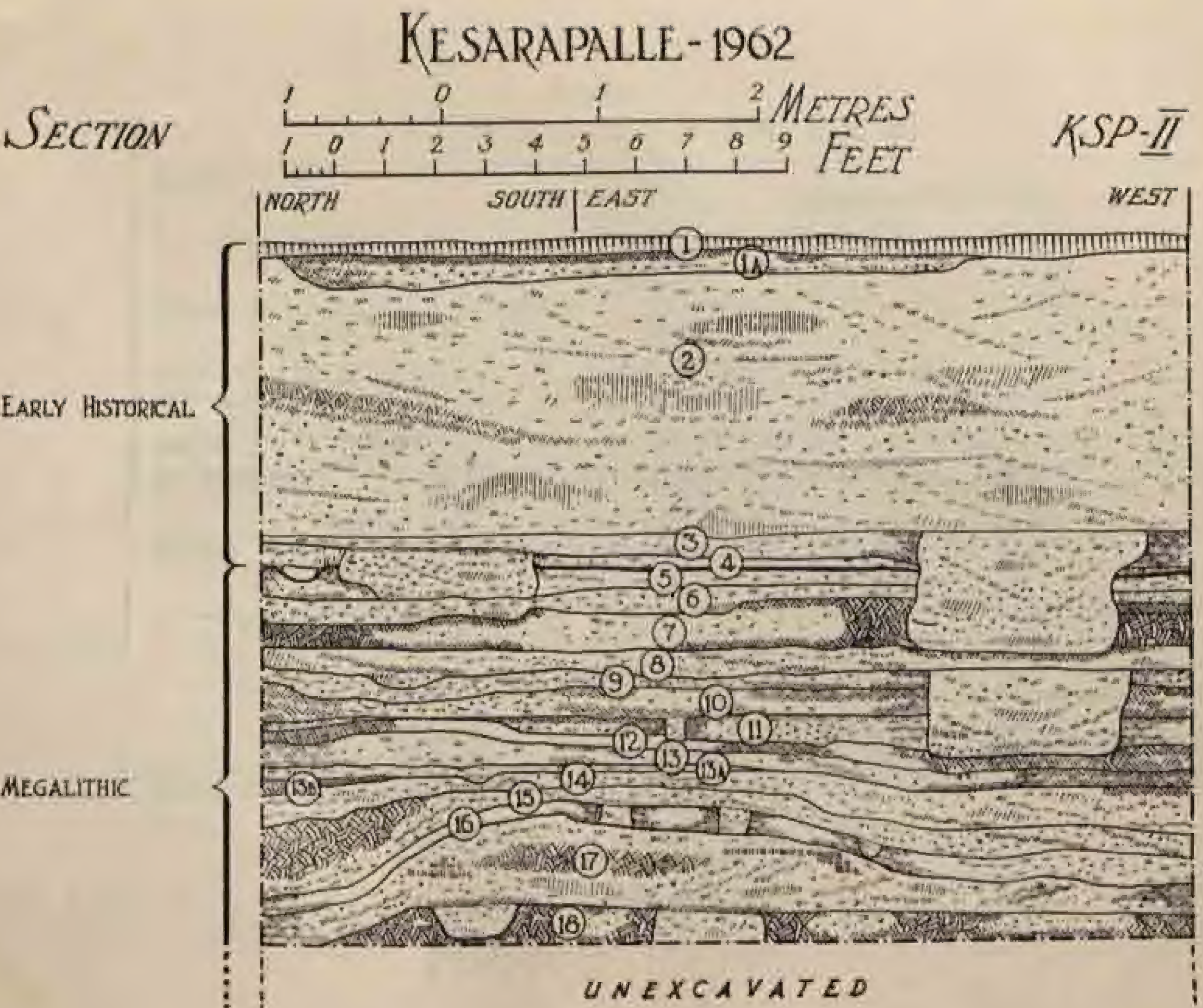

KESARAPALLE-1962
SECTION
METRES
FEET
KSP-II
NORTH
SOUTH
EAST
WEST
EARLY HISTORICAL
MEGALITHIC
UNEXCAVATED

FIG. 3.

another.[1] Burnt earth, bands of deposit of mollusc-shells, potsherds and bone fragments formed the main infilling of these pits. Again, in some cases they were edged by post-holes, varying in diameters from 18 to 25 cm.

The last phase of the chalcolithic culture showed a significant overlap with the megalithic, indicating the arrival of a new people with certain distinctive cultural traditions (below, p. 47). A terracotta spacer-bead with four horizontal perforations, a specimen of which was also recovered from the actual megalithic level, was the only object worth special mention.

Period II.—For the first time iron made its appearance in this Period along with typical megalithic pottery. Painting; and decorations on pottery became almost non-existent; post-firing graffiti were noticed on a few pots. The types mainly comprised the deep bowl, vase, dish, lid-*cum*-bowl, jar, basin and urn; in frequency and variety, the deep bowls outnumbered any other type. Iron objects included mostly indeterminate pieces, although a spear-head and a wedge were discovered from the megalithic burial-site. A copper cylinder-circular-bead and a bone spacer-bead, similar to that of the preceding Period, came from this level.

The people lived in some shelters, for post-holes were quite common; some triangular depressions or pits, noticed in these levels, might have been used as some sort of hearths as these were filled in with chunks of burnt earth and ash. Animal bones were found in the same quantity as that of the previous period, but the occurrence of mollusc-shells showed a definite decline. In all likelihood, the people were responsible for the construction of cist-burials found near the modern Leprosy Hospital.

The occurrence of a sherd of the Northern Black Polished Ware from the upper level of the megalithic occupation in KSP-2 may indicate overlap of the two distinct pottery-traditions.

Period III.—It has been divided into two Sub-periods on the basis of the occurrence of the Rouletted Ware in the earlier one and absence in the latter.

The Rouletted Ware appeared in Sub-period III A in KSP-1; it was, however, found overlying the occupational deposit of the megalithic culture in KSP-2. One of the sherds of the Ware, collected from the surface, had a riveting with iron pins. Other antiquities comprised iron nails with bent head, stone beads and a few shell objects.

Sub-period III B was only the continuation of the earlier one with the difference that the Rouletted Ware practically ceased to exist. A number of brick structures noticed in different parts of the mound probably belonged to this Sub-period. It is interesting to note that certain types in black-and-red ware continued.

Period IV.—Very little could be ascertained in respect of this period which, in KSP-1, disclosed a decadent pottery-tradition similar to that of the late medieval times of Nagarjunakonda and Yeleswaram.

5. CHRONOLOGY

Except Period IV, the late medieval dating of which is obvious, there are only two more or less firm grounds in the chronology of Kesarapalle—the occurrence of a sherd of

[1] The occurrence of interlapping pits on a particular spot may suggest a time-interval, for no one in normal circumstances would dig pits within earlier ones in living memory. It may tend to show that the cultural deposits of this locality possibly represented the relics of groups, who might not have been wholly sedentary, notwithstanding their more or less homogeneous character.

the Northern Black Polished Ware from the upper levels of the megalithic culture and the Rouletted Ware in Sub-period III A. The characteristic Rouletted Ware bearing concentric rings of rouletted pattern round the interior of the base was dated at Arikamedu by its association with the imported Roman pottery like the Arretine Ware to the second quarter of the first century A.D.[1] On the basis of this evidence the beginning of Period III at Kesarapalle may easily be dated to the middle of the first century A.D. Whatever may be the reason, this distinctive ceramic industry disappeared in the subsequent Sub-period which was possibly coterminous with the Ikshvāku rule in the lower Krishna basin. It may be recalled here that Nagarjunakonda, which rose to prominence from the second quarter of the third century to about the first quarter of the fourth century, did not yield any Rouletted Ware. There are reasons to doubt whether this Ware had its use during the rule of the last few Sātavāhana kings who preceded the Ikshvākus and whose cultural vestiges in the form of coins and an inscription were discovered at Nagarjunakonda. Hence the period of the duration of the Rouletted Ware, consequently Period III A of Kesarapalle, may be dated from the middle of the first to at least the beginning of the third century.

It has not been possible to establish an overlap of the megalithic with the Rouletted Ware, though it is certain that the latter immediately followed the former at Kesarapalle. On the basis of the stratigraphic evidence at Sengamedu[2] one may as well assume an overlap of both the cultures and consider the middle of the first century A.D. as the *terminus ad quem* of the megalithic occupation of Kesarapalle: Brahmagiri[3] as well as Maski[4] also suggest the same date for the end of the megalithic cultures there. On the strength of these evidences it would be safe to fix the later limit of the megalithic deposit of Kesarapalle to about the middle of the first century A.D.

For computing the period of duration and determining the earlier limit of the megalithic culture one has to rely partly on the date of the Northern Black Polished Ware and partly on the reconstruction of time-scale based on stratified deposit. The sherd of the Northern Black Polished Ware, generally dated from the sixth century to second century B.C., occurred about 60 cm. below the uppermost limit of the megalithic occupation, which continued further down to a depth of 2 m. or more. Now, the discovery of an Aśokan inscription at Amaravati[5] may indicate that the Northern Black Polished Ware reached Amaravati, Chebrolu and Kesarapalle by 250 B.C. when this Mauryan emperor started constructing *stūpas*, edicts and pillars in Andhra region. Moreover, the Āndhras, who are mentioned in the thirteenth Rock-edict of Aśoka, had been living within his dominion. That the Northern Black Polished Ware spread to the Andhra region by about 250 B.C. is, therefore, quite reasonable.

It has already been stated that 2-m. deposit of megalithic habitation lay beneath the stratum yielding the sherd of the Northern Black Polished Ware, and it is certainly not a wild conjecture to postulate that this accumulation should represent at least two

[1] R. E. M. Wheeler, 'Brahmagiri and Chandravalli 1947: megalithic and other cultures in the Chitaldrug District, Mysore State', *Ancient India*, no. 4 (1948), p. 200. Also see, 'Arikamedu: an Indo-Roman trading-station on the east coast of India', *ibid.*, no. 2 (1946), pp. 34–49.

[2] N. R. Banerjee, 'The megalithic problem of Chingleput in the light of recent exploration', *Ancient India*, no. 12 (1966), p. 32.

[3] Wheeler, *op. cit.* (1948), p. 202.

[4] B. K. Thapar, 'Maski 1954: a chalcolithic site of the southern Deccan', *Ancient India*, no. 13 (1957), p. 20.

[5] D. C. Sircar, 'Fragmentary pillar inscription from Amaravati', *Epigraphia Indica*, XXXV, pt. 1 (1962), p. 43.

centuries. Thus, the beginning of the megalithic culture at Kesarapalle may be dated to the middle of the fifth century B.C., which, incidentally marked the closing phase of the chalcolithic period there as well.

There is another consideration for assuming middle of the fifth century B.C. as the upper limit of the megalithic culture at Kesarapalle. A few fragments of the dish in all-black ware, with inturned rim and blunt carination near the base (fig. 5, *19*), reminiscent of similar types in the Painted Grey Ware[1] and in the assemblage associated with the Northern Black Polished Ware, came from the lower levels of the megalithic occupation—perhaps for the first time in the period of overlap. Again, a few sherds of deep bowl with a prominent rib around the body in the exterior (fig. 5, *18*) have their parallels in Period I at Ujjain;[2] even the shiny grey slip on its reddish surface is similar to that of Ujjain. These evidences may tend to show that the megalithic culture of Kesarapalle came in contact in some way or the other with the ceramic tradition connected with the Northern Black Polished Ware quite early in the history and distribution of the latter. Also, it is not unlikely that the period of overlap represented the commingling of three trends, viz., chalcolithic, megalithic and a northern tradition associated with the Northern Black Polished Ware. Viewed from this angle, dating the megalithic culture to the middle of the fifth century B.C. may not appear far wide off the mark.[3]

One may as well argue on the basis of the same evidence that the contact of the megalithic culture with the Northern Black Polished Ware took place only in the second century B.C., that being the last-known chronological limit of the Northern Black Polished Ware; in other words, the end of the chalcolithic, the beginning of the megalithic and at the same time, the intrusion of the Northern Black Polished Ware tradition should have to be dated to the second century B.C. But the occurrence of the Northern Black Polished Ware sherd in an upper level of the megalithic culture precludes such a possibility, for a time-interval has to be postulated for the 2-m. megalithic deposit below the layer which produced the characteristic sherd; if the earlier contact were to take place by about the second century B.C., the latest date of the N.B.P. Ware at Kesarapalle has to be brought down to the early Christian era, which is most unlikely in view of the emergence of the Rouletted Ware in the middle of the first century A.D. In the circumstances, the arrival of certain trends associated with the Northern Black Polished Ware within the megalithic complex of the lower Krishna basin cannot be ruled out, and it happened by about the middle of the fifth century B.C., when the chalcolithic culture almost merged with the megalithic.

To fix up the early limit of the chalcolithic period is, however, fraught with difficulties in the absence of any firm datum. Undoubtedly, it should be dated posterior to the central Indian chalcolithic complex[4] but how much later is not easy to guess. If the upper limit of the chalcolithic culture at Kesarapalle is dated to the middle of the fifth century B.C., its beginning may perhaps be assigned a date of *circa* 750 B. C.

[1] B. B. Lal, 'Excavations at Hastināpura and other explorations', *Ancient India*, nos. 10 and 11 (1954 and 1955), p. 48, fig. 12, type XXV, and its variants of Period II.

[2] Information from Dr. N. R. Banerjee. Also see, *Indian Archaeology* 1956-57—*A Review*, pp. 24–25, fig. 12, 27.

[3] The beginning of the megalithic culture in the south has been dated to 700 B.C. by N. R. Banerjee in his paper entitled 'The chronology of megaliths in south India—a review', read before the International Conference on Asian Archaeology, New Delhi, 1961.

[4] For chronology based on Carbon-14 dates of some of these cultures see, B. B. Lal, 'A picture emerges—an assessment of the Carbon-14 datings of the protohistoric cultures of the Indo-Pakistan subcontinent', *Ancient India*, nos. 18 and 19 (1962 and 1963), pp. 214-16.

on the ground that a deposit of 2·40 m. should represent about three centuries. Though this is nothing but an assumption, yet in the present state of archaeological investigation this dating seems to be rational because of the following considerations. The chalcolithic culture of Kesarapalle appears to be later than Brahmagiri and Sanganakallu, both being dated to *circa* 1000 B.C., in view of the rarity of neolithic tools and the absence of microlithic industry at the present site. Similarly, it must have taken time for the black-and-red ware of the central Indian chalcolithic complex with its almost spent-up impulse, at least so far as the painted tradition is concerned, to travel to the lower Krishna basin. How much time it took to reach Kesarapalle is, however, difficult to ascertain, but in case one is inclined to recognize in this trend the dispersal of people as a sequel to the Aryan expansion in the south the provisional date of eighth century B.C. will not appear unreasonable, for the Āndhras as a people find their earliest mention in the *Aitareya-Brāhmaṇa*, which was compiled prior to the sixth century B.C.

In summary, then, the tentative chronology of the occupational deposits at Kesarapalle is as follows:

PERIOD I : middle of the eighth to the middle of the fifth century B.C.

PERIOD II : middle of the fifth century B.C. to the middle of the first century A.D.

SUB-PERIOD III A : middle of the first century A.D. to the beginning of the third century A.D.

SUB-PERIOD III B : first or second quarter of the third century to the middle of the fourth century A.D.

PERIOD IV : late medieval.

6. DIFFERENT CULTURAL ELEMENTS

Though not much information in respect of composition and material equipment of different cultural phases of Kesarapalle could be gleaned due to the limited scope of the present operation, yet it has to be admitted that Kesarapalle provided for the first time a continuous index of cultures that flourished in the lower Krishna basin from the chalcolithic to the early historical period.

In the absence of any other suitable term, Period I of Kesarapalle has been designated here as 'chalcolithic' in spite of the fact that neither any stone implement nor even a bit of copper came to view in the excavation. It does not necessarily mean that these two items were completely absent, for they might have been missed in the restricted operation and may, let it be hoped, be brought to light by a large-scale operation. There are, however, indications of the use of neolithic celts in Period I because of the occurrence of two specimens on the surface. Moreover, the high water-table did not also allow the excavation to reach the natural soil; as a result, no information regarding the genesis of the chalcolithic phase there could be obtained.

Basically, this culture developed out of the neolithic tradition of the Deccan and Karnataka because of the higher frequency of burnished grey and its associated wares compared to that of the intrusive black-and-red ware of a probable central Indian association. At this stage it is but necessary to make it clear the sense in which the terms 'neolithic' and 'chalcolithic' are being used here without, however, entering into controversy as to their definitions and essential components. The term 'neolithic' is applied here to denote a cultural tradition characterized by the use of short-blade microliths, neoliths and burnished grey and other associated wares. This is not a hypothetical stage of cultural evolution since Nagarjunakonda displayed almost an

identical pattern. It was preceded at Nagarjunakonda by a still archaic phase devoid of burnished grey ware although the short-blade microlithic industry on chert and a crude red ware formed its basal elements; neoliths were extremely rare in this period. If this primitive trend marked the advent of the neolithic economy in the south, Brahmagiri I,[1] Sanganakallu II,[2] Maski I[3] and Piklihal I,[4] *minus* the intruding elements represented by painted pottery tradition, chert ribbon-flakes and copper or bronze, should signify its mature form. In fact, Sanganakallu II and some sites at Nagarjunakonda, where neither the painted pottery nor any long chert blades made their appearance, may be taken as nearer to true neolithic phase than any other site in the Deccan. The extraneous elements referred to above, which are collectively styled as 'chalcolithic', might have entered the Deccan from the north. Thus, the neolithic culture of the Deccan in some period of its development derived certain traits from one or more chalcolithic sources, thereby giving birth to mixed cultures in different parts of the plateau. That a substratum of neolithic tradition existed beyond the proper neolithic culture-zone may also be postulated from the occurrence of burnished grey ware in the lower levels of the sites like Nevasa,[5] Daimabad,[6] Bahal,[7] Bahurupa,[8] Nagda[9] and Gilund[10] but the temporal limit of this northward extension of the neolithic culture has yet to be worked out.

Now, the neolithic traits were represented at Kesarapalle only by the occurrence of burnished grey and its associated red wares, with types similar to those from Brahmagiri, Sanganakallu, Maski, Piklihal, Nagarjunakonda, etc. One of the characteristics of the neolithic culture of Nagarjunakonda was its association with pits of various dimensions, and Kesarapalle as well possessed them. At the same time, it is to be borne in mind that unlike Nagarjunakonda and Sanganakallu, Kesarapalle had no microliths, nor was its neolithic industry a prolific one. Admittedly, the black-and-red ware and a feeble trend of paintings thereon represented only a foreign element grafted on an old neolithic pattern which by then had lost many of its original traits. Evidence collected during the present dig is too meagre to suggest any definite source of inspiration for the black-and-red ware, but this ware has not been reported from Brahmagiri, Sanganakallu, Maski and Piklihal, where the common occurrence of long chert blades, painted pottery and, at some of these sites, of terracotta figurines indicated a common trend emanating from one horizon. Kesarapalle did not share any of these features, and as such one has to assume, to explain the occurrence of black-and-red ware at Kesarapalle, a distinct movement of traits or infiltration of ideas, if not a migration of people, from another region. Indeed some of the types, for instance *10* and *11* (fig. 4) and *15* (fig. 5) of Period I of Kesarapalle, bear comparison with those from different sites belonging to chalcolithic complex of central India and Rajasthan.

No generalization on the similarity in painted motifs should be hazarded because of their paucity at Kesarapalle. It can only be said that in both the painted sherds the

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[1]Wheeler, *op. cit.* (1948), pp. 223–25 (painted pottery) and pp. 250–53 (long chert blades).

[2]B. Subbarao, *Stone Age Cultures of Bellary* (Poona, 1948), p. 10.

[3]Thapar, *op. cit.*, pp. 38-40 (for painted pottery) and p. 90 (for long chert blades).

[4]F. R. Allchin, *Piklihal Excavations* (Hyderabad, 1960), pp. 56–57.

[5]H. D. Sankalia, S. B. Deo, Z. D. Ansari and S. Ehrhart, *From History to Prehistory at Nevasa (1954-56)* (Poona, 1960), p. 207.

[6]*Indian Archaeology 1958–59—A Review*, p. 15.

[7]*Ibid., 1956–57*, p. 17.

[8]*Ibid., 1958–59*, p. 24.

[9]*Ibid., 1955–56*, p. 14.

[10]*Ibid., 1959–60*, p. 41.

painting occurs in the interior: in one case in fugitive white and in the other in black on a grey surface. This practice of decorating the interior of the pot is noticed at Ahar, Bahurupa, Manoti and at a number of other sites.

It is evident from the foregoing that a trend from northern direction, maybe from central India, reached the lower Krishna basin and merged itself in the neolithic complex there. So far as the lower Krishna basin and, in particular, Kesarapalle are concerned, one may trace the arrival of three distinct trends in different periods, the earliest of which was a chalcolithic wave from somewhere in central India. At the last phase of this mixed culture came the megalith-builders with their characteristic pottery and burial-tradition; this was also the time when certain ceramic types associated with the Northern Black Polished Ware reached the scene. During this period certain trends, as exemplified in the pottery-types, had their continuity. Theoretically speaking, all cultural traits cannot suddenly vanish howsoever severe be the impact from outside. It is thus natural that the megalithic culture absorbed many features from the earlier or contemporary cultures and eventually proved to be the most dominant one in the lower Krishna valley some time in the fifth-fourth century B.C. That it was quite extensive too in this region is evident from wide distribution of megalithic monuments in Guntur and Krishna Districts.

7. SOME OBSERVATIONS ON THE CULTURAL SEQUENCE OF THE LOWER KRISHNA BASIN

It is necessary at this stage to assess how far the present operation fulfilled the main objectives as detailed above (p. 38). Undoubtedly, the excavation at Kesarapalle has bridged considerably the occupational hiatus noticed in the cultural sequence of Nagarjunakonda which, though bringing to light a continuous chain of evolution of cultures from the Early Stone Age to the neolithic, was deficient in the succeeding periods. In all likelihood, Periods I and II and Sub-period III A of Kesarapalle should come between the end of the neolithic culture of Nagarjunakonda on one hand and the rise of Ikshvāku power in the lower Deccan on the other. The cultures of the first two Periods and of the first Sub-period of the next of Kesarapalle possibly failed to penetrate into the secluded valley of Nagarjunakonda because of the fact that the region, being rocky, was not suitable for the development of food-producing economy. By and large, the chalcolithic cultures in India developed on riverine plains which assured a stability in the production or supply of food and also created a precondition for sedentary habits. Perhaps the megalith-using people followed the same tradition and built their settlements in the arable tract, though the actual megaliths were built on wastelands bordering the hills.

Nagarjunakonda did reveal several megalithic remains mainly grouped into two clusters, but unlike Kesarapalle no megalithic habitation could be located there despite a thorough search. Yet Kesarapalle is not the only site in the lower Krishna basin where the burials occurred in proximity to the actual settlement, for habitational mounds close to the megaliths have been noticed by the present writer at Moṭadaka[1] (pl. XXVI B) near Guntur and at Nemalipuram,[2] about 63 km. from Guntur. On the other hand, there are several sites in Guntur, Krishna and Nalgonda Districts where occupational deposits near the megalithic monuments seem to be absent altogether. Does it mean that some groups preferred to raise megaliths close to their habitation and the others far away

[1] *Indian Archaeology 1960-61—A Review*, p. 1.
[2] *Ibid.*, *1961-62*, p. 1.

from their settlements as the Pharaohs of Egypt did for the pyramids? Time has not come to put forth such a theory, but the reason for the absence of megalithic occupation at Nagarjunakonda will remain inexplicable unless it is assumed that this valley was used merely as a burial-ground of a particular group who might have had their settlement at a distant locality. The cultural assemblage recovered from the megaliths of Nagarjunakonda does not provide any clue as to their probable date, but the absence of typical megalithic pottery in the neolithic as well as the historical deposits there may indicate their chronological position subsequent to the neolithic culture of the valley though certainly anterior to the rise of the Ikshvākus.

Let it be mentioned here that the dating that has been suggested for the megalithic culture at Kesarapalle (above, p. 45) may not be applicable to all the groups located in the Krishna basin. Indeed, Krishna and Guntur Districts are quite rich in megalithic monuments, and as early as 1882 Robert Sewell[1] listed no less than two dozen sites, the maximum concentration of which were in Venukonda Taluk of Guntur District. In the circumstances, the date-range for all these groups is likely to vary considerably; further, they do not also conform to one type. So far as the knowledge of the present writer goes, at least four distinct groups may easily be defined, viz. (i) stone-circle with underground cist, (ii) stone-circle with burial-pit, (iii) dolmenoid-cist, and (iv) urn-burial. While Kesarapalle showed a predominance of underground cists, the authors of the Nagarjunakonda megaliths seemed to have some predisposition for burial-pits (pl. XXVI A); the latter feature was noticed also at the much-spoilt site at Lam, near Guntur. No specimen belonging to the third category has been excavated in Krishna and Guntur Districts, although at Yeleswaram, District Nalgonda, a number of similar megaliths were opened. So far only two regions, Amaravati and Yeleswaram, yielded urn-burials. Thus it is evident that the megalithic culture, possibly representing at least four cultural elements, had a widespread distribution in the lower Krishna basin, and that no definite scheme of chronology of these monuments can be evolved without systematic survey of the entire region.

It has already been stated that Nagarjunakonda megaliths antedated the historical ruins of the Ikshvākus because of the total absence of megalithic pottery and other artefacts in the latter deposits. That a time-interval of at least two centuries existed between the megaliths and the Ikshvāku remains may thus be affirmed on the evidence of Kesarapalle where the Rouletted Ware intervened between the two periods.

Lastly, the reason for the absence of the Rouletted Ware at Nagarjunakonda does not need any further explanation, for it appears that the Ware, particularly the technique of rouletting, had stopped by the time the Ikshvākus came to the scene.

8. DESCRIPTION OF THE CUTTINGS

Cutting KSP-1

A trench (fig. 2; pl. XXI A) measuring 4 by 3 m. was laid at the site. It was dug to a depth of 5·80 m. from the surrounding ground-level, but the natural soil could not be reached due to high water-table (25th March, 1962). The occupational deposit revealed three main cultures, viz., chalcolithic, megalithic and late medieval, although some pottery belonging to early historical period was also recovered from layer 3. Layers 5,

[1]Robert Sewell, *Lists of the Antiquarian Remains in the Presidency of Madras*, Archaeological Survey of South India, New Imperial Series, I (Madras, 1882), pp. 42–85.

5 A and 5 B represented the period of overlap of the chalcolithic with megalithic culture. Below this deposit was found the occupational débris, about 2·60 m. in height on an average (excluding the layers showing overlap), of the chalcolithic culture. This accumulation, divisible into five strata, layers 6, 7, 7 A, 8 and 9, disclosed two successive pits cut one within the other. The megalithic phase here had a maximum deposit of 1·40 m. represented by layers 4, 4 A, 4 B, 4 C and 4 D, yielding typical megalithic pottery and iron. Some post-holes, belonging possibly to some oblong hut, belonged to this period. The entire deposit appeared to be some sort of successive floor-levels with abundant patches of ash and burnt earth. A few regular depressions filled in with ash and burnt earth were identified as ovens. Above the megalithic habitational deposit lay a stratum, layer 3, of compact reddish brown earth, yielding mixed pottery including a Rouletted Ware sherd. Three uppermost layers with a total thickness of 1·10 m. exposed sherds of late medieval pottery.

Cutting KSP-2

A trench (fig. 3) measuring 4 by 2 m. was laid at the bottom of an exposed section of the early historical period, with a view to stratify the entire deposit. Here also natural soil could not be reached owing to high water-table. The entire deposit comprising exposed as well as excavated portions had a maximum height of 4·60 m. and represented two main cultures, viz., megalithic and early historical. Only a maximum height of 2·40 m. on an average of megalithic occupational deposit could be exposed. Its bottommost part disclosed a dump labelled as layer 17. Of the excavated portion, only layers 3 and 4 yielded the Rouletted Ware but no significant overlap with the megalithic culture was observed here. Layer 7 revealed a sherd of the Northern Black Polished Ware along with typical megalithic pottery. A huge dump, layer 2, of early historical times from which were recovered several sherds of the Rouletted Ware also, was found superimposed over layer 3. Layers 1 and 1 A yielded pottery ascribable to Period III B.

9. OBSERVATIONS ON SURFACE-EXPLORATIONS

A. Megalithic remains

(i) *Location*

The megalithic remains, as revealed in the surface-exploration, covered an extensive area to the north of the Leprosy Hospital. There is a great likelihood of these burials extending below the compound of the said Hospital as well as within the limits of the aerodrome. Locally the area is known as *jangal dibbā* or *yarlā paḍu*, i.e., red soil area; this red soil was being quarried here for use as road-metal. The spoliation was so complete that hardly a slab was spared, though sometimes pottery can be traced lying *in situ*.

(ii) *Stratigraphy*

This wanton digging for red gravel left at the site many an exposed section providing an opportunity to study the stratigraphy of the site. Bed-rock, found at an average depth of 1·40 m. from the surrounding ground-level, consisted of pinkish granite; the upper portion of this stratum was quite soft presumably owing to some prolonged water absorption. This was superimposed by a dark-brown gravelly layer (layer 3), the upper part of which was full of small to medium-sized water-worn pebbles. It had an average



A. *Cutting KSP-1.* *See p. 49*



B. *Kesarapalle: view of a megalithic cist in road-section.* *See p. 51*



A. *Kesarapalle: general view of a water-logged area with a megalithic cist in foreground.* *See pp. 38 and 51*



B. *Kesarapalle: brick structure of Sub-period IIIB in an exposed part of mound.* *See p. 51*

thickness of about 80 cm. and was found overlain by a deposit (layer 2), about 50 cm. in thickness of light-brown gravel mixed with sand and earth. Broadly speaking, the size of these gravels was normally smaller than that in the underlying deposit (layer 3). All these layers were bereft of any cultural material, and the top-soil varied in thickness from 10 cm. to 60 cm.

Megaliths were dug either in the softer part of the bed-rock or in the reddish gravelly layer (layer 3); it is difficult to presume that this difference signifies the priority of one group over the other unless the working-levels for both could be determined. A partially-mutilated megalithic cist (pl. XXI B) noticed on the road-section had its pit cut into the gravelly-layer from the top of layer 2.

(iii) *Types of megaliths*

No visible remains of megaliths in the form of stone-circles or cairn-heaps could be noticed on the surface since these were buried under an accumulation varying in thickness from 10 cm. to 60 cm. Traces of stone-circles, however, were observed in the exposed sections. Only megalithic cists, presumably buried ones, came to light indicating the prevalence of a more or less uniform type of megalithic monuments. This inference was drawn after a careful examination of the available traces often represented either by a slab or mere impressions of slabs on the ground; on rare occasions all the four orthostats of a cist (pl. XX) were preserved. Capstones (pl. XXII A) dislodged from the original position were seen scattered here and there. Unfortunately, the contents of these chambers including the skeletal remains had been removed completely save a few pots and objects of iron. It may be recorded here that no port-hole was noticed on any of the available slabs, made generally of dressed granite.

Cists were laid invariably in north-south orientation and often in regularly-arranged groups. In length they ranged from 1·65 to 2·35 m., in width from 39 cm. to 1 m., in height from 45 to 90 cm. and in thickness from 9 to 15 cm.; one intact capstone measured 2·50 m. × 1·35 m. × 15 cm. Pottery must have been laid outside the oblong chamber and in some cases at least, also on the surface of the sealed pit, a practice noticed in certain cases at Nagarjunakonda and also at Lam, near Guntur. Besides pottery, the surface-exploration brought to view a few iron objects like a wedge and a spear-head.

B. Structural remains of the early historical period

Though the central part of the mound was practically devoid of any structure, the south-eastern and the north-western fringes of the mound revealed traces of some brick structures. The last-mentioned area seems to be the part of *rājū dibba* or 'king's mound' situated at the rear of the modern Gannavaram village: the extant brick structure covering an area of 50 sq. m. was represented in many places by four courses of brick (pl. XXII B), the average size of which was 41 × 25 × 8 cm. No definite plan could be made out but it appeared to be plundered ruins of a fairly big secular building which possibly came into existence in a period that immediately followed the disappearance of the Rouletted Ware.

To the west of the modern *Nāga*-temple and within the village jurisdiction of Kesarapalle were seen traces of a number of circular brick structures in which wedge-shaped bricks had been employed. The largest one had a diameter of about 1·77m.; on its opposite side were found three more examples arranged almost in a row and also equidistant from each other. It is difficult to guess the utility of these structures, with an extant height of about 40 cm. Their use as wells or soak-pits has to be ruled out

in view of their small dimensions and their occurrence in one particular area. It is not unlikely that these were used perhaps as some sort of bins for storing grains; this would explain their arrangement in some alignment and concentration on one spot. The pottery associated with these structures may be dated to *circa* third-fourth century A.D. because of their similarity with the Nagarjunakonda ceramic industry of that period. A lead coin, very similar to the Ikshvāku issue, came from an area not far away from these structures.

10. POTTERY

By M. D. Khare

A. Period I

(i) *General observations*

The wares available in Period I in order of frequency are grey, all-black, red and black-and-red. In some cases it is difficult to ascertain whether the broken rim-sherds belong to black-and-red ware or to black ware, as the type in both the wares are more or less similar.

The fabric of red ware is mostly coarse and occasionally medium. The paste could not be levigated properly as sand-particles and grit had been mixed into it. But the paste of the other three wares appears to have been prepared out of a better clay, the texture of which ranges from medium to fine without the presence of much sand and grit. Quite a few pots have an irregular interior, which shows that the potter did not pay much attention to it. But for a few huge jars and some rims, the entire pottery is made on a slow wheel; it is also proved by the availability of prominent wheel-grooves on the interior of some of the sherds. Paring-marks can also be seen on sherds of this period. In some instances wheel-made rims have been luted to the hand-made bodies.

The red ware is mostly well-fired, although there are cases of bad firing as indicated by grey or black core of thick jars and black patches on red surface. Carelessly-levigated paste as well as the thick section of the pottery may suggest that pots could not be fired to a high degree of temperature. Thin-sectioned black-and-red and black-slipped wares and thick grey ware have also been subjected to reducing conditions of heat in the kiln, which resulted in the crumbling of the sherds into small pieces; the abundance of small sherds recovered from this period substantiates the hypothesis. All-black and black-and-red wares have a better finish and shiny appearance as a result of burnishing, though 40 per cent of the pots hardly carry any slip at all.

A groove around the neck or the body is noticed occasionally. Incised slashes, pinched marks, finger-tips and twisted cord-designs are some of the decorations. A thin raised band, though irregular, is seen on type *4*. Impressions of husk and grass occur mostly on red ware. Graffiti-marks are very rare (below, p. 58). Two painted sherds, one of them carrying a black design on grey ground and the other white on black, are noteworthy.

In spite of the fact that the pottery of this period is in fragments, the available types consist of medium-sized jars, bowls, jars, lids-*cum*-dishes and stands in order of frequency in all wares. These forms have their own individuality and can easily be isolated from those of the later periods. The nearest parallelism of the majority of the types of this

period is found in several other sites of south India; particular mention may, however, be made of Brahmagiri, Sanganakallu, Maski, Piklihal and Nagarjunakonda.

(ii) *Plain ware*

FIG. 4

Type 1. Wide-mouthed jar with a splayed out and internally carinated rim of grey ware. *12-14* below possibly served for this type as lids which would easily rest on the carination. Of thick coarse fabric, it is burnt grey in section and also has an indifferently-fired surface. It carries a light-red slip on the exterior.

Type 2. Jar of red ware with an out-turned rim. Of thick and very coarse red ware, it is burnt black in section and carries a thin reddish brown slip. A number of horizontal lines run around the neck on the exterior.

Type 3. Vase of coarse red ware with a featureless flaring rim and expanding shoulders. Marks of luting the rim with body at the neck can be seen very clearly on the interior. It is devoid of any slip and burnt grey in section, with uniformly-red exterior and interior.

Type 4. Red ware vase with a mild carination at the neck on the interior. It is of medium size having thin walls and is indifferently fired. The soot-stained exterior indicates its use as a cooking vessel. A thin raised band, irregularly made, runs around the shoulder; impressions of husk can be noticed below the band. *Variant 4a* is smaller but thicker in section. Of medium grey ware fabric, it has a smoothened exterior.

Type 5. Medium-sized vase of grey ware with a featureless out-turned rim and widening shoulder. Of medium to fine fabric, it is treated with a black slip on the exterior and has paring-marks. *Variant 5a* is thicker and coarser than the archetype.

Type 6. Vase of a burnished grey ware with externally cut rim. Of medium to fine fabric, it carries a black slip on the exterior. Marks of luting can be seen on the irregular interior below the neck.

Type 7. Vase of an all-black ware, of medium fabric, with a wide mouth and featureless rim.

Type 8. Bowl of red ware. Of coarse and medium fabric, it is unevenly fired. Paring-marks over the mildly-carinated waist can be noticed. *Variant 8a* is smaller and thinner than above and has more prominent paring-marks below the black-slipped interior. *Variant 8b* has a wide mouth, like a basin, in all-black ware, with grooved exterior and interior besides the shiny surface.

Type 9. Bowl of black ware with a featureless, outcurved rim. Of medium to fine fabric, it carries a shiny exterior. *Variants 9a* and *9b* are smaller and thinner than the archetype and are of fine grey ware, carrying a glossy exterior.

Type 10. Medium-sized bowl of black-and-red ware and of medium fabric.

Type 11. Bowl of black-and-red ware with concave sides and mildly carinated waist.

FIG. 5

Type 12. Carinated medium-sized deep bowl of black ware with a burnished exterior. *Variant 12a* is of black-and-red ware and has a prominently ledged waist. Of medium fabric, it has a glossy appearance on the exterior which may indicate that its exterior was used more often than the interior.[1]

Type 13. Shallow lid-*cum*-dish of black-and-red ware. Paring-marks below the shiny surface are noticeable.

Type 14. Also lid-*cum*-dish of black ware of medium fabric, having collared rim and slipped interior. *Variant 14a* differs in having an externally cut rim. It is burnished and is of medium to fine fabric of black ware.

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[1]The type is commonly met with at the megalithic sites but occurs also at the chalcolithic urn-burial site at Tekwada. See *Indian Archaeology 1956–57—A Review*, p. 19, fig. 8.

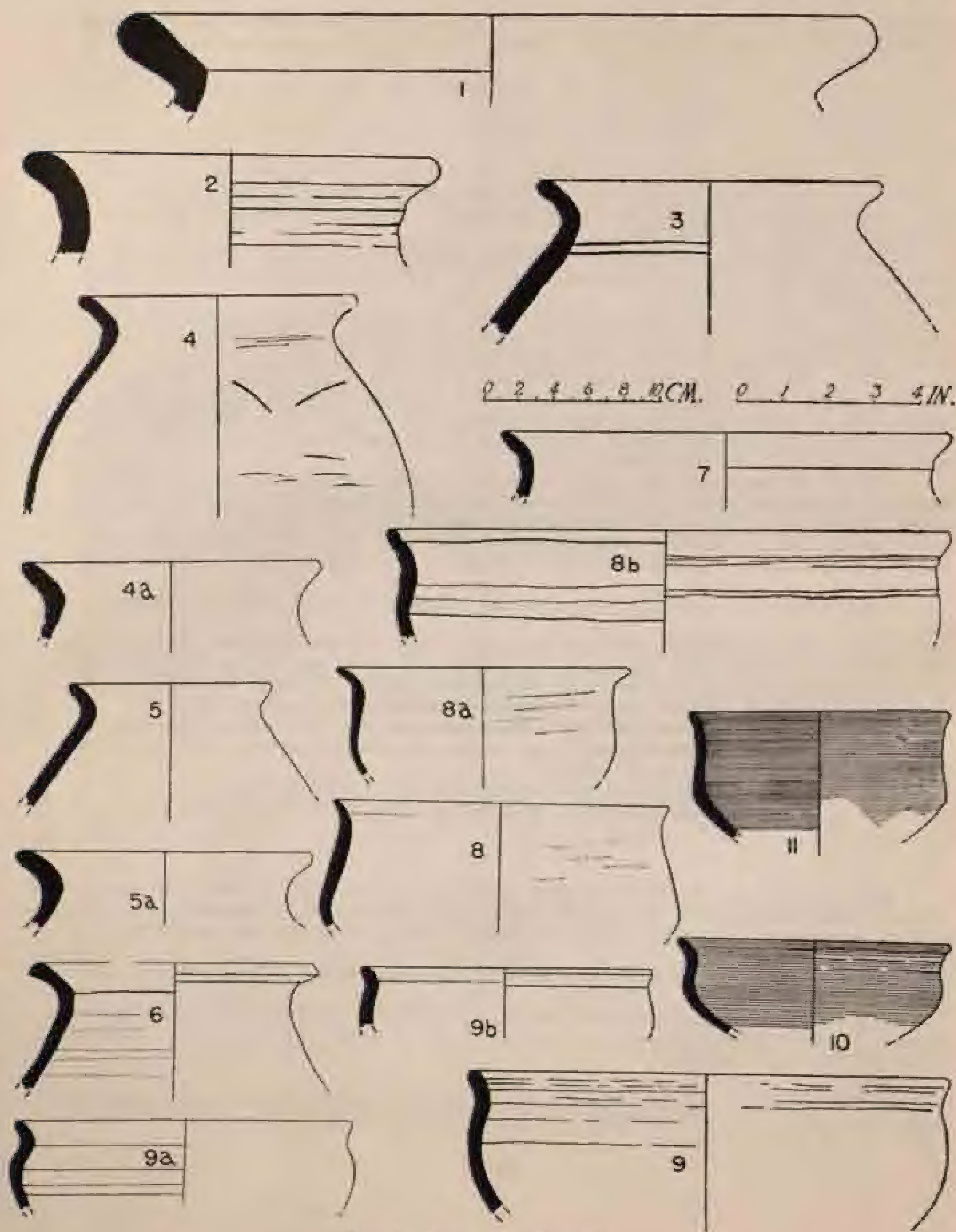


FIG. 4. *Pottery from Period I*

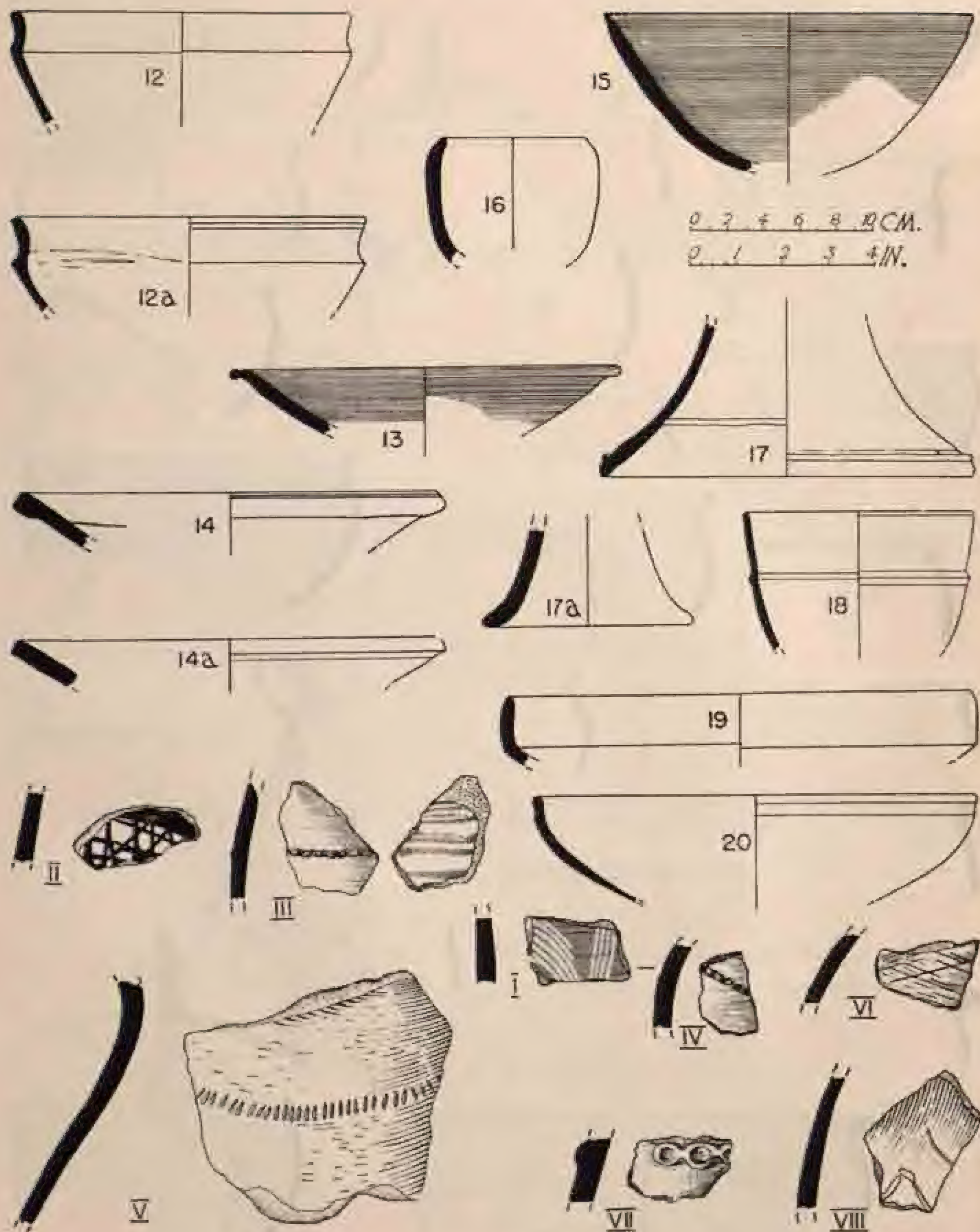


FIG. 5. *Pottery from Period I*

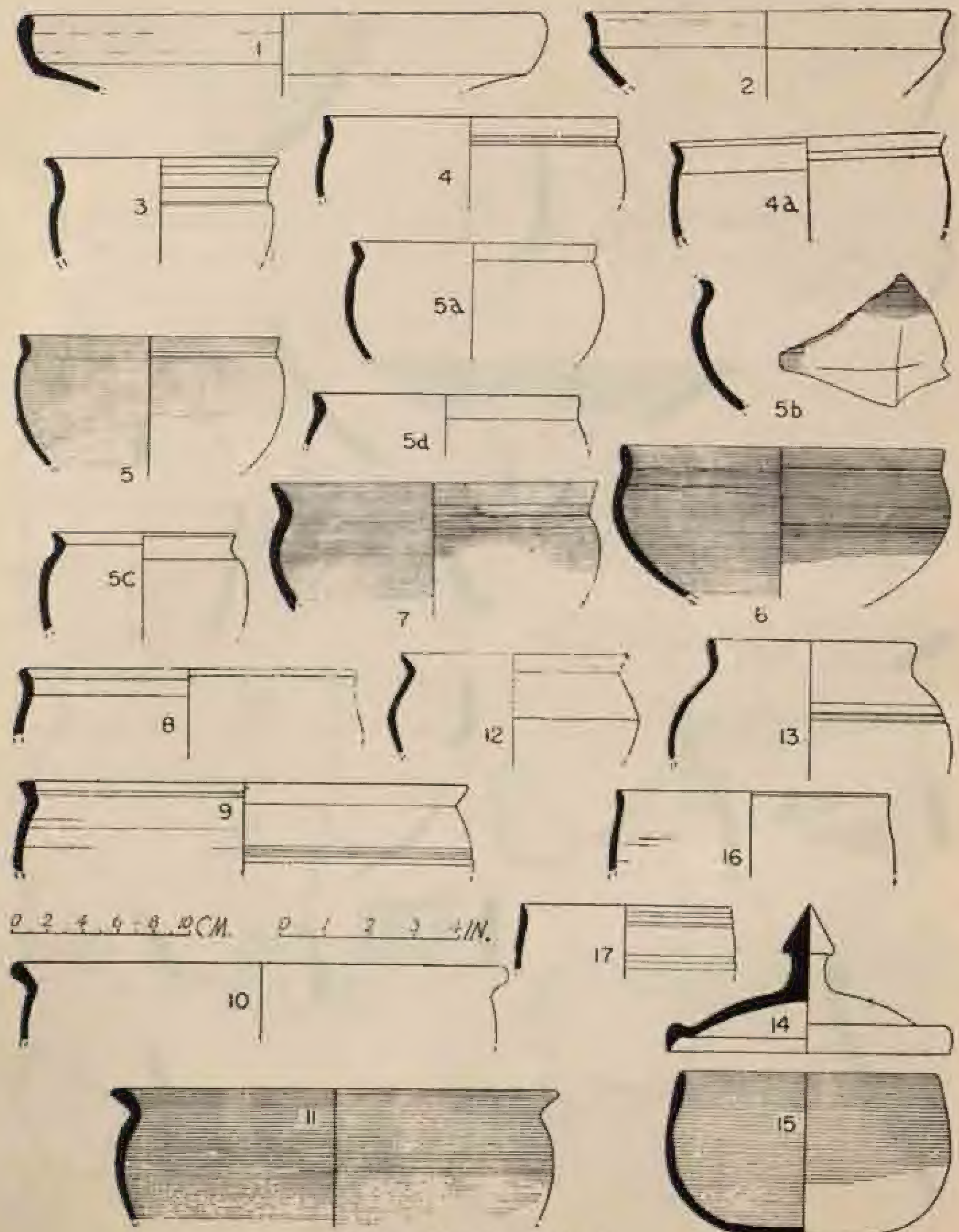


FIG. 6. *Pottery from Period II*

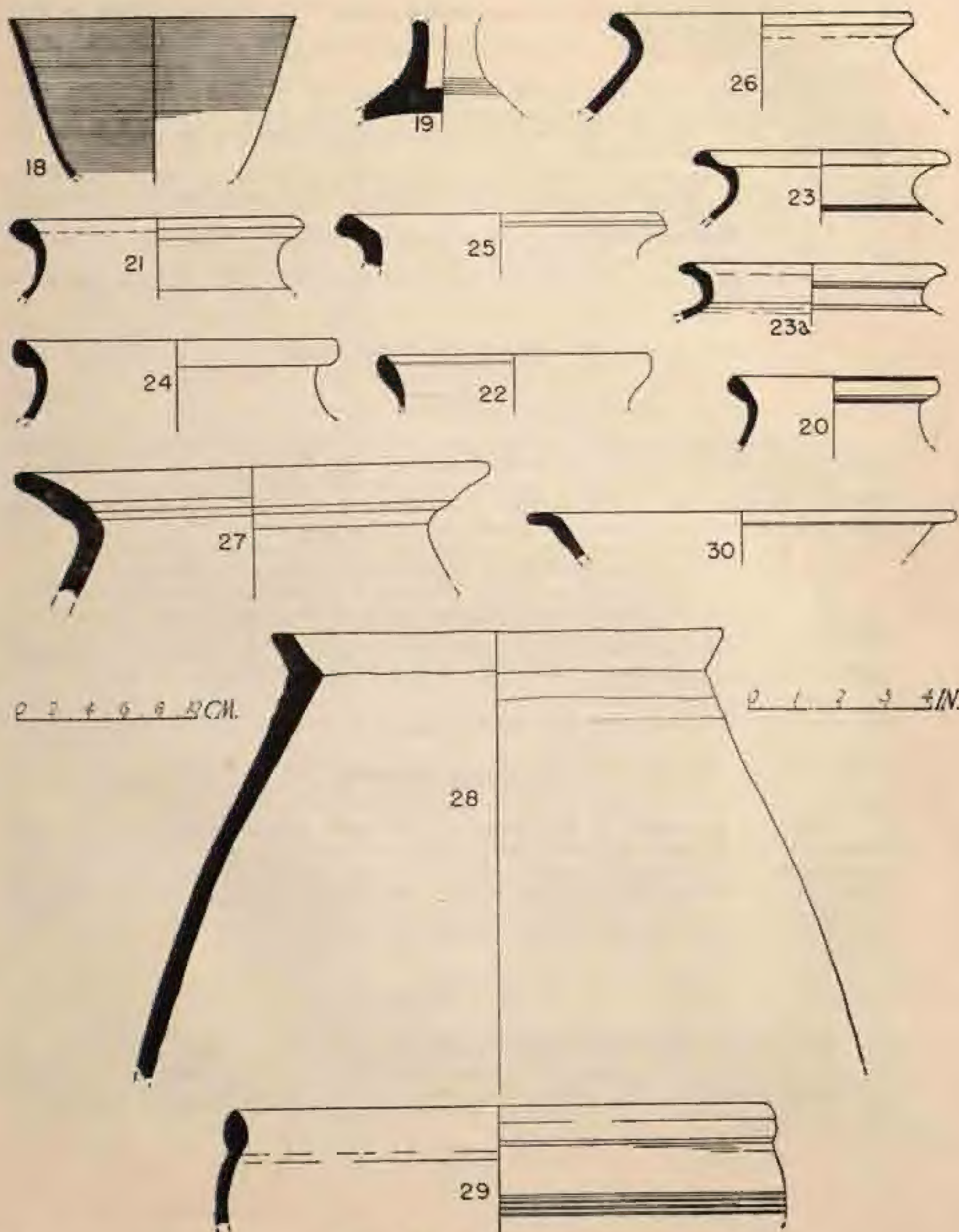


Fig. 7. Pottery from Period II

Type 15. Burnished black-and-red ware bowl of medium fabric comparatively thick but well-fired; it carries a glossy exterior.

Type 16. Coarse red-ware miniature mug having an inturned rim. It is unevenly fired and is devoid of slip.

Type 17. Black ware stand having collared rim-base and elongated narrowing sides. Of medium to fine fabric, it has paring-marks and glossy exterior. *Variant 17a* is in red ware but smaller than above. It has a featureless everted rim-base, and prominent paring-marks on the exterior below a reddish brown slip.

Type 18. Unique deep bowl with a rib around the body on the exterior and correspondingly a grooved interior. Of medium-to-fine red, it is well-fired and has a shiny grey slip on both sides. From the period of overlap.

Type 19. Black ware dish with carinated waist and polished on either side. Of medium to fine fabric it comes from the period of overlap.

Type 20. Black ware dish carrying a shiny black slip on either side. Of medium fabric it comes from the period of overlap.

(iii) *Painted and decorated sherds*

Fig. 5

I. Thick sherd of black-and-red ware painted on the interior with a fading white on black background. It is of medium fabric and carries paring-marks on the exterior below a shiny surface.

II. Painted sherd of black-and-red ware, carrying black design on black interior.

III. Grey-ware sherds, decorated with a twisted cord pattern made by punching the raised band on the black-slipped exterior and painted with black on grey interior.

IV. Dull-red ware decorated sherd, carrying mildly-punched marks on the exterior.

V. Thick grey-ware hand-made sherd carrying incised strokes on the exterior.

VI. Red-ware sherds, marks on exterior appear to be of the impressions of husk.

VII. Thick red-ware sherd, carrying a finger-tip design on a raised band of clay on the exterior.

VIII. Red ware sherd carrying some graffito on the exterior. Its complete form cannot be determined, as it is damaged. The sherd is uniformly fired and carries a thin slip.

B. Period II

(i) *General observations*

Period II is marked by the appearance of purely megalithic types. The wares represented are the same as those of the preceding period though grey ware is very feebly represented; all-black ware is, however, thicker in section than Black-and-red Ware. The pottery is well-fired and made on faster wheel. Wheel-grooves on the interior of the pots in general are scarce and decorations almost nil, slips in use being mostly black or red. Period II yielded an N.B.P. sherd also (above, pp. 40–45).

(ii) *The types*

The number of pots and also their sherds are rather limited; the commonest shapes are also available at Brahmagiri, Porkalam, Maski, Sanur, Piklihal, Yeleswaram, Nagarjunakonda, Kunnattur, etc. Dishes and bowls are the commonest types; jars, basins, lids and lid-*cum*-dishes are also available from this period.

FIG. 6

Type 1. Dish of black ware with an incurved rim, carinated waist and sagger-base. It is of medium fabric.

Type 2. Sharply-carinated bowl of black ware. Of medium fabric, it carries a black slip on both sides.

Type 3. Deep bowl of black ware, having a ledged shoulder and slipped on both sides.

Type 4 and *variant 4a.* Deep bowls of all-black ware with featureless rims. Of medium to fine fabric, both have been treated with a glossy black slip.

Type 5 and *variants 5a, 5b, 5c* and *5d.* Black-and-red ware bowls, also typical of megalithic period. Of medium to fine fabric, they are well-fired and have a glossy appearance. *Variant b* bears post-firing graffito. *Variants c* and *d* are of all-black ware and thicker in section than above.

Type 6. Typical megalithic type of Black-and-red ware bowl.

Type 7. Black-and-red ware bowl of coarse to medium fabric.

Type 8. Black ware bowl of medium fabric, carrying black slip on both sides.

Type 9. Medium-sized bowl of black ware with a flat-topped rim and grooved shoulder. Of medium to fine fabric, it is slipped on both sides.

Types 10 and *11.* Bowls respectively of all-black and Black-and-red wares.

Type 12. Small-sized carinated bowl, having a black slip on the exterior and interior up to the rim.

Type 13. *Loṭā*-type of black ware. Of coarse to medium fabric, it is treated with a black slip on the exterior and interior up to the rim.

Type 14. Typical all-black ware lid-type available in megalithic deposits; used possibly as a lid for 15. From a megalithic burial.

Type 15. Black-and-red ware bowl, also typical of megalithic period, with a glossy appearance. From a megalithic burial.

Types 16 and *17.* Bowls of Black-and-red ware.

FIG. 7

Type 18. Bowl of well-fired Black-and-red ware with highly-polished sides.

Type 19. Unique base-fragment of thick and coarse grey-ware. It is difficult to surmise its use, as only the stem over the damaged base is available.

Types 20–26. Small to medium-sized pots of red-ware, ranging in fabric from coarse to fine, and coming mostly from early levels. *23* and its *variant 23a* are unique because of their grooved rims on the interior. Most of them are uniformly fired though black patches can also be noticed on *24* and *25*.

Type 27. Thick red ware jar akin to those found in Period I. Of coarse to medium fabric, it is treated with a bright red slip and has a micaceous interior.

Type 28. Red ware jar of huge dimensions. Of medium fabric, it is over-fired and appears to be hand-made.

Type 29. Wide-mouthed basin of red ware, treated with a red slip on both sides and is uniformly fired. Its body is grooved.

Type 30. Red ware lid-*cum*-dish having a horizontally flaring rim for grip.

C. SUB-PERIOD III A

(i) *General observations*

Period III gave plenty of pottery with variety of forms, fabric, treatment and decorations. The shapes of the vessels are often indicative of their being put to different uses; for instance, huge troughs and jars were possibly used for storage-purposes, medium-sized *ghaṭas* for fetching water, carinated vessels for cooking, and so on. As usual, the

red ware forms the bulk and is well-fired, though instances of indifferent firing are also not wanting. The fabric ranges from coarse to medium with a little percentage of finer wares; less grit and sand appear to have been mixed in the paste. The entire pottery appears to be wheel-made and the striation-marks are indicative of the use of a fast wheel. The potter, by then, was experienced enough to prepare thin-sectioned pottery, which could be well-fired to make it more durable. This is evident from the availability of fine red-ware types and the local imitation of Rouletted Ware dishes, which are much superior to those meant for common use. There is, however, a deterioration in the quantity and quality of *de luxe* wares. The black-and-red ware is represented by a typical sharply-carinated dish and deep bowl with featureless rim. Decorations are mostly incised slashes, oblique strokes, wavy lines and leaf-designs etc., but applied finger-tip patterns are also there. It is interesting to note that wheel-grooves disappeared completely.

By looking into the decorations it may not be difficult to ascertain as to which type was meant for ceremonial and religious purposes. A decorated sherd (fig. 10, *III*) having a lotus-design indicates a ceremonial use.

(ii) *The types*

The pottery of this period is comparable with the types occurring at a number of sites in south and north India, like Dharanikota, Nagarjunakonda, Yeleswaram, Kondapur, Salihundam, Brahmagiri, Maski, Arikamedu, Sisupalgarh and Ahichchhatra, etc. The types represented are: bowls (fig. 8, *1–7*); dishes (fig. 8, *8–21*); basin (fig. 8, *22*); lids (fig. 9, *23–29*); lamps (fig. 9, *30*); vases (fig. 9, *31–38*); wide-mouthed vessels (figs. 9 and 10, *39–46*); cooking-vessels (fig. 10, *47* and *48*); wide-mouthed jars (fig. 10, *49* and *51*); troughs for storage (fig. 10, *52* and *53*); and sprinklers (fig. 10, *54*). Of them the dishes with internally-beaked or chamfered rims are imitations of similar types in the Rouletted Ware and are available in fairly good quantities in Sub-period III A. The lids were used either as lid-*cum*-dishes or lid-*cum*-bowls; that they were used as lids is evident from the slip applied on one surface only, the other being intended to remain inside another pot. Some unique red ware vases are strengthened by the provision of internally-collared rims for an easy grip as also for the lid to rest. Small to medium-sized vases, mostly with nail-head and at times with collared rims, are available in large numbers and some of them appear to have been used as *loṭās*. Cooking-vessels can be identified from their general shape and also from soot-stains. They are with or without carination at the waist.

Fig. 8

Type 1. Red ware bowl, uniformly fired and carrying reddish-brown slip on both sides.

Type 2. Black ware shallow bowl with mild carination at the waist. Of coarse to medium fabric, it is slipped on either side.

Type 3. Shallow bowl of black-and-red ware. Of medium fabric, it has got a slipped interior.

Type 4. Uniformly-fired black-and-red ware shallow bowl of medium fabric, having shiny appearance. *Variant 4a* is a miniature size in the type.

Type 5. Bowl of black ware with slightly everted rim and multi-grooved exterior. Of medium to coarse fabric, it is slipped on both sides.

Type 6. Deep bowl of black-and-red ware with an everted rim and thin sides. Of medium fabric, it is slipped on both sides.

Type 7. Base-fragment of a black-and-red ware deep bowl. Of coarse to medium fabric, it carries a light slip on both sides.

Types 8–14. Dishes of black-and-red ware, mostly of thick section. While first four are of medium fabric, the latter three, of coarse fabric, have no glossy appearance. *12* is the deepest and has an internally-collared rim like *13*.

Type 15. Dish of red ware with internally-cut rim. Of medium to fine fabric, it is treated with a dark pinkish-brown slip, which has turned blackish due to firing.

Type 16. Shallow dish of red ware. Of thick and coarse fabric, it is indifferently fired and is treated with a light brown slip on the interior.

Types 17–18. Dishes of black-and-red ware. *17* has an incurved rim and *18* has thickened one. Both have carinated waists. Of coarse to medium fabric, they are slipped.

Type 19. Dish of red ware with short sides and sagger-base. Of coarse fabric, it is ill-fired and has two vertical lines on the exterior.

Type 20. Thick red ware dish having vertically-incised strokes below the groove on the exterior. It is treated with a bright-red slip on both sides and is well-fired.

Type 21. Dish of all-black ware, shallower and thinner than above. It has an internally thickened rim and is slipped on the exterior.

Type 22. Shallow basin of red ware used for cooking-purposes as indicated by the soot-stained exterior. It has a nail-head rim and is of coarse to medium fabric, treated with a red slip on both sides.

FIG. 9

Type 23. Lid-*cum*-dish of red ware with a drooping rim. Of coarse fabric, it is ill-burnt and is treated with a reddish brown slip now spoiled due to soot on both sides. It appears to have been used as a lid of a cooking-vessel.

Types 24 and *25.* Lid-*cum*-bowls of red ware with ledged waist, which could rest on the rim of a vessel. Of coarse fabric, they have not been uniformly fired and appear to have been used on the cooking vessels.

Types 26–28. Lids of the medium-sized pots, perhaps meant for containing water. *26* has a horizontally splayed-out rim and conical base, the exterior being rough. Of medium fabric, it is well-fired and treated with a bright red slip on the exterior. *27* has a nail-head rim, is ill-fired and carries a wash. The lower part of the exterior has marks of paring. *28* is akin to above and devoid of any slip, though well-fired.

Types 29 and *variants 29a* and *29b.* Red ware conical bowls, usually having flat bases. All of them have prominent wheel-grooves on either side and are of coarse fabric. They are uniformly fired and devoid of any slip.

Type 30. Fragment of a lamp of coarse red ware having pinched lip for a wick. It is burnt grey in section and is devoid of any slip.

Type 31. Vase with finger-nail decoration on the exterior of the flaring rim. Treated with a bright-red slip on both sides. Of coarse to medium fabric, it is burnt grey in section.

Type 32. Vase with a horizontally-splayed out rim and with a grooved exterior in place of finger-tip decoration. Of medium fabric, it is not uniformly fired.

Type 33. Vase with a horizontally-splayed out rim carries a finger-nail decoration on the exterior and treated with a light reddish brown slip. Of medium fabric it is burnt grey in section.

Type 34. Small-sized vase of red ware with a narrow neck and also treated with a light red slip on the exterior and interior up to the out-turned rim. Of coarse to medium fabric, it is burnt black in section.

Type 35. A coarse red ware vase of a *loṭā* type having a grooved exterior. It was treated with a red slip, which has mostly disappeared.

Types 36 and *37.* Small to medium-sized vases with nail-head rim, widening profile and wide mouth. *36*, which is thinner and well-fired, is treated with a red wash and has a pinkish brown slip on the exterior. *37* has turned dark because of underfiring.

Type 38 and *variant 38a.* Vases with narrow necks which can very well receive the lids of *Types 26–27.* The widening profile is quite striking and so also the bright red-slip on the exterior and interior up to the rim. Both are of medium fabric and well-fired.

Type 39. Wide-mouthed vessel, with an externally-thickened rim. Of medium fabric, it is underfired.

Type 40. Wide-mouthed vessel with a collared rim. Of medium fabric, it is burnt grey in section and treated with a light-red slip on both sides.

Type 41. Wide-mouthed vessel with a thickened rim and grooved exterior. Of medium fabric, it is uniformly fired and treated with a light-red slip on the exterior.

Type 42. Unique wide-mouthed vessel, with an incurved rim. Uniformly fired, it is of coarse fabric and is treated with a light-red slip.

Type 43. Wide-mouthed vessel with a thickened and internally-recessed rim. Of coarse to medium fabric, it is uniformly fired and treated with a light-red slip on both sides.

Type 44. Wide-mouthed vessel with a nail-head rim. Of coarse red ware, it is overfired.

Fig. 10

Types 45-46. Wide-mouthed vessels with externally thickened and grooved rims. Both are of coarse fabric and burnt grey in section and treated with red slip. *46* differs from *45* in having a long neck and finger-nail decoration on the exterior.

Type 47. A red ware vessel, presumably with a carinated body, now missing. Of medium to coarse fabric, it is treated with a red slip and is soot-stained.

Type 48. With a widening profile and out-turned rim, it is typical of preceding periods. It carries a rectangular graffito (post-firing) on the exterior and is treated with a red slip on the exterior and interior up to the rim. Soot-stains, particularly on the interior, can be noticed.

Types 49 and *50.* Wide-mouthed jars with thickened rims, carinated on the interior. Of coarse to medium fabric, they are burnt black in the gritty sections. Both of them carry a red slip on the exterior and interior up to the rim.

Type 51. As above with a drooping rim. Of coarse gritty fabric, it is burnt grey in section and treated with a reddish brown slip on both sides.

Type 52. Typical trough with an internally-thickened rim to receive the lid and externally decorated with a twisted-cord design on a raised band. Of coarse gritty fabric, it is burnt black in section and treated with a bright-red slip on both sides.

Type 53. Disc-base of a trough. Of coarse and gritty red ware, it is burnt black in section and treated with a light red slip. *Variant 53a* is a conical bowl of red ware with disc-base. *Variant 53b* is uniformly fired, while *53a* is burnt grey in section. Both are devoid of any slip.

Type 54. Fragment of a sprinkler of fine red ware. It is well-fired and treated with a pinkish brown slip on the exterior. The central narrow opening is partly visible, while the secondary perforated part is completely damaged.

(iii) *Decorated pottery*

A number of decorated sherds carrying incised, stamped and applied designs have been recorded, but only a few are described here.

I. Fragment of a trough, usually met with in the historical levels having multi-grooved shoulder above wavy design.

II. Shoulder-fragment of a huge jar decorated with a twisted-cord design on a raised band, incised oblique strokes, thin incised lines and double triangles below.

III. Jar-fragment decorated with a lotus-pattern over a twisted-cord design in appliqué.

IV. Red-ware multi-grooved fragment carrying irregularly incised and notched dots between the grooves.

V. Black-slipped sherd having incised leaf-design.

VI. Red-ware sherd having incised leaf-design within grooves.

VII. Red ware sherd having incised dots below an irregularly-made leaf-design.

VIII. Red ware sherd having vertically-incised lines on one of the two horizontal grooves.

IX. Sherd with incised lines along the body.

X. Sherd with graffito in the form of a cross below the grooved neck.

XI. Body-fragment of a red ware jar having a pair of perforations. This type appears to have been used for keeping the fire burning. The air could pass through the perforations. The interior is indicative of its being in touch with fire constantly.

(iv) *The Rouletted Ware*

FIG. 11, *1* to *12*

All the ten rim-sherds of the Rouletted Ware have typical internally-bevelled rim and differ only in shades of the surface. The core is invariably grey. *11* and *12* are fragmentary bases having rouletted marks on the interior, but from their shapes and fabric the rest, *1* to *10*, may be reasonably regarded as belonging to the same class.

(v) *Pottery discs*

FIG. 11, *A* to *F*

A number of circular discs made out of the broken pot-sherds, by rubbing their broken sides, have been recovered. The children are likely to have used them for playing a game known as *gippi* which is very common even today. But they could have been used as weights also. Such circular sherds of various sizes and thicknesses have been reported from a number of historical sites. Only six examples have been illustrated here. *E* is of fine red ware carrying polished sides, while *F*, which is the smallest, is slipped on the exterior only (below, p. 74).

D. SUB-PERIOD III B

(i) *General observations*

This sub-period is distinguished from the preceding one by the absence of the Rouletted Ware. Moreover, the quantity of the pottery also decreases. The types available are much less than found in Sub-period III A. The form, fabric, firing and finish, etc., are, however, similar in both the Sub-periods.

(ii) *The types*

The following types are represented: bowls (fig. 12, *1*, *2* and *14*); dishes (fig. 12, *3* and *4*); lids, also used either as bowls or dishes (fig. 12, *5–7*); vase (fig. 12,*8*); medium-sized pots (fig. 12, *9* and *10*); carinated vessels (fig. 12, *11*); wide-mouthed jars (fig. 12, *12*); spouted vessels (fig. 12, *13*); and jars (fig. 12, *15*).

FIG. 12

Type 1. Bowl of black-ware with an everted rim and multi-grooved exterior. Of coarse fabric, it is slipped on the exterior and interior up to the rim.

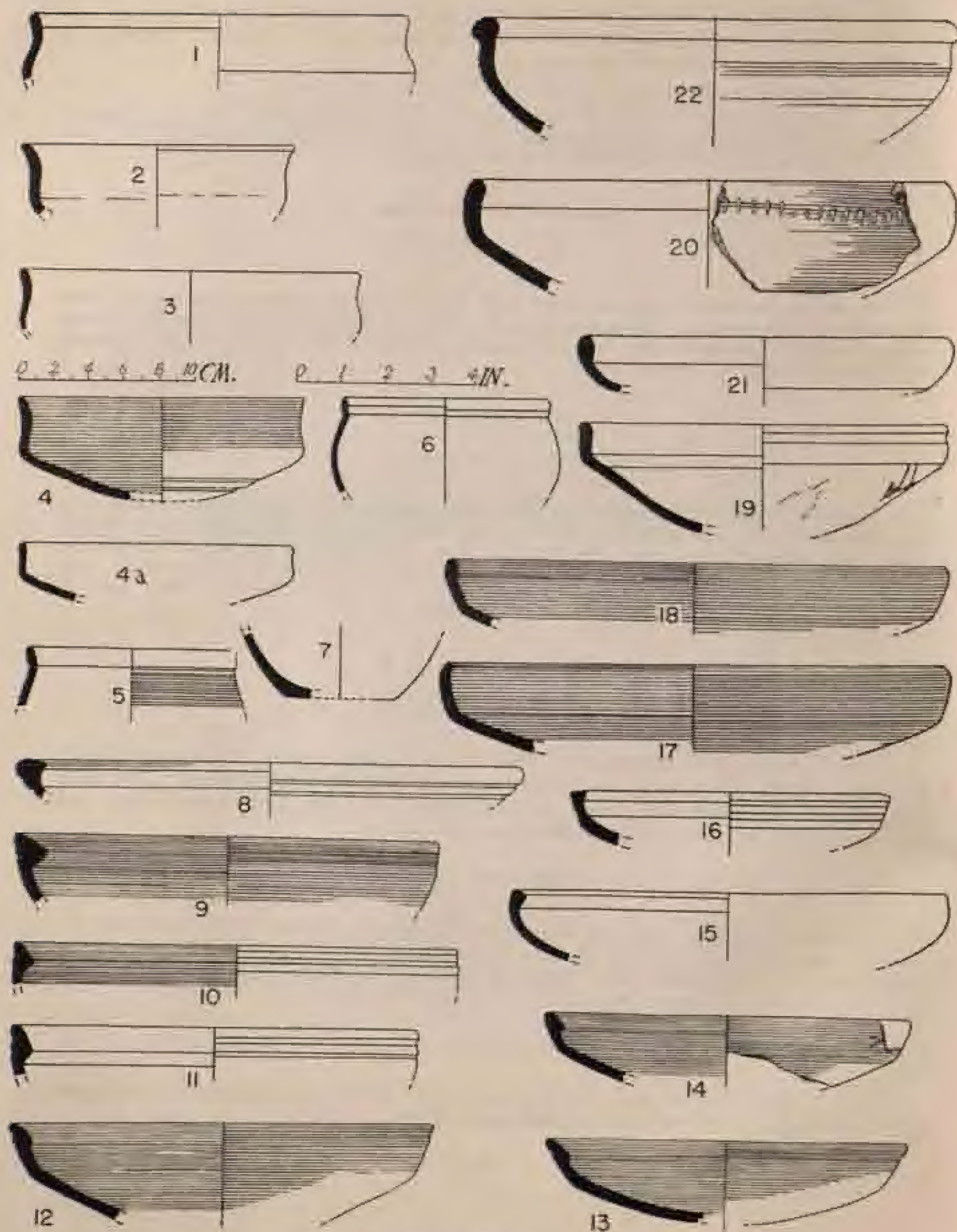


FIG. 8. *Pottery from Sub-period III A*

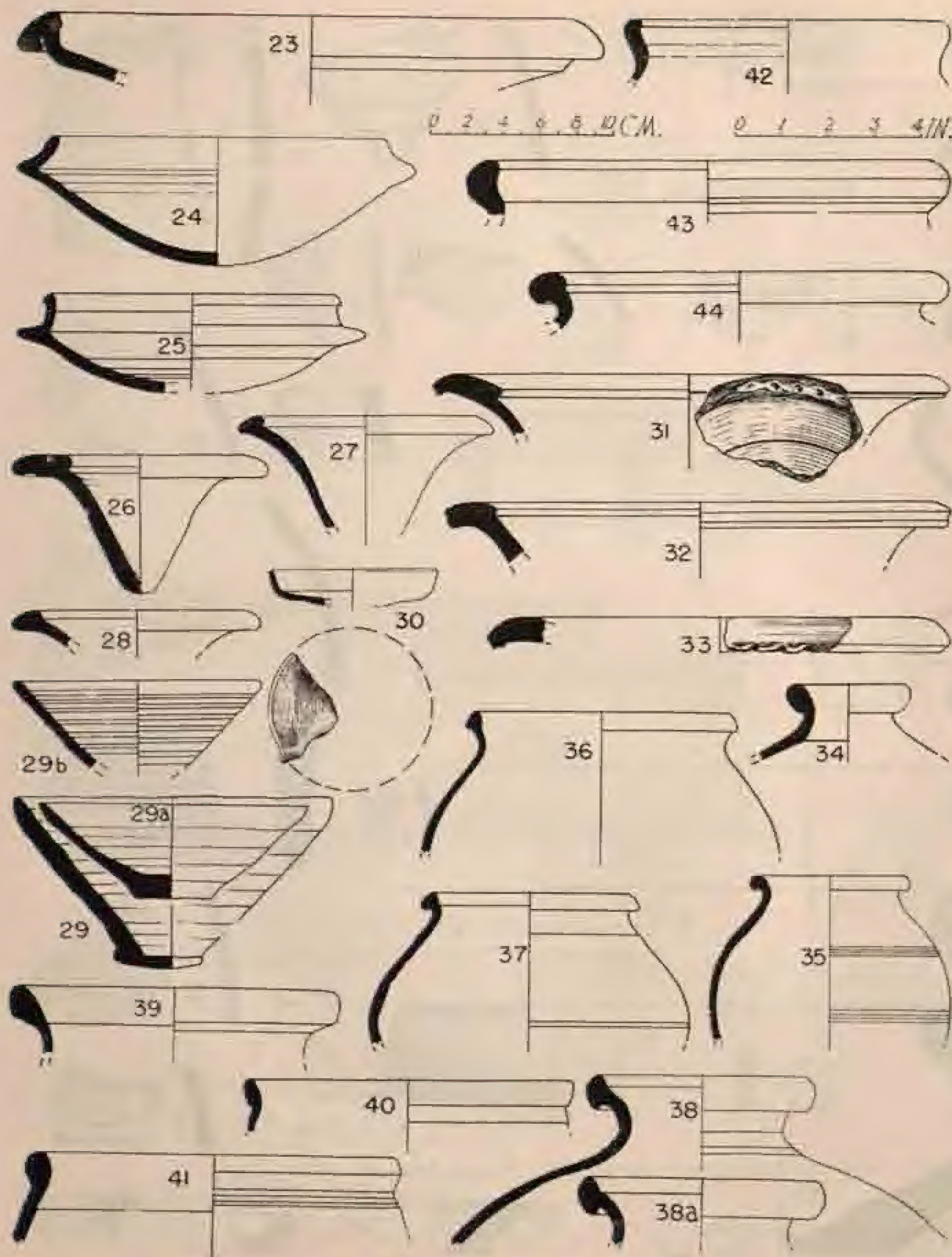


FIG. 9. *Pottery from Sub-period III A*

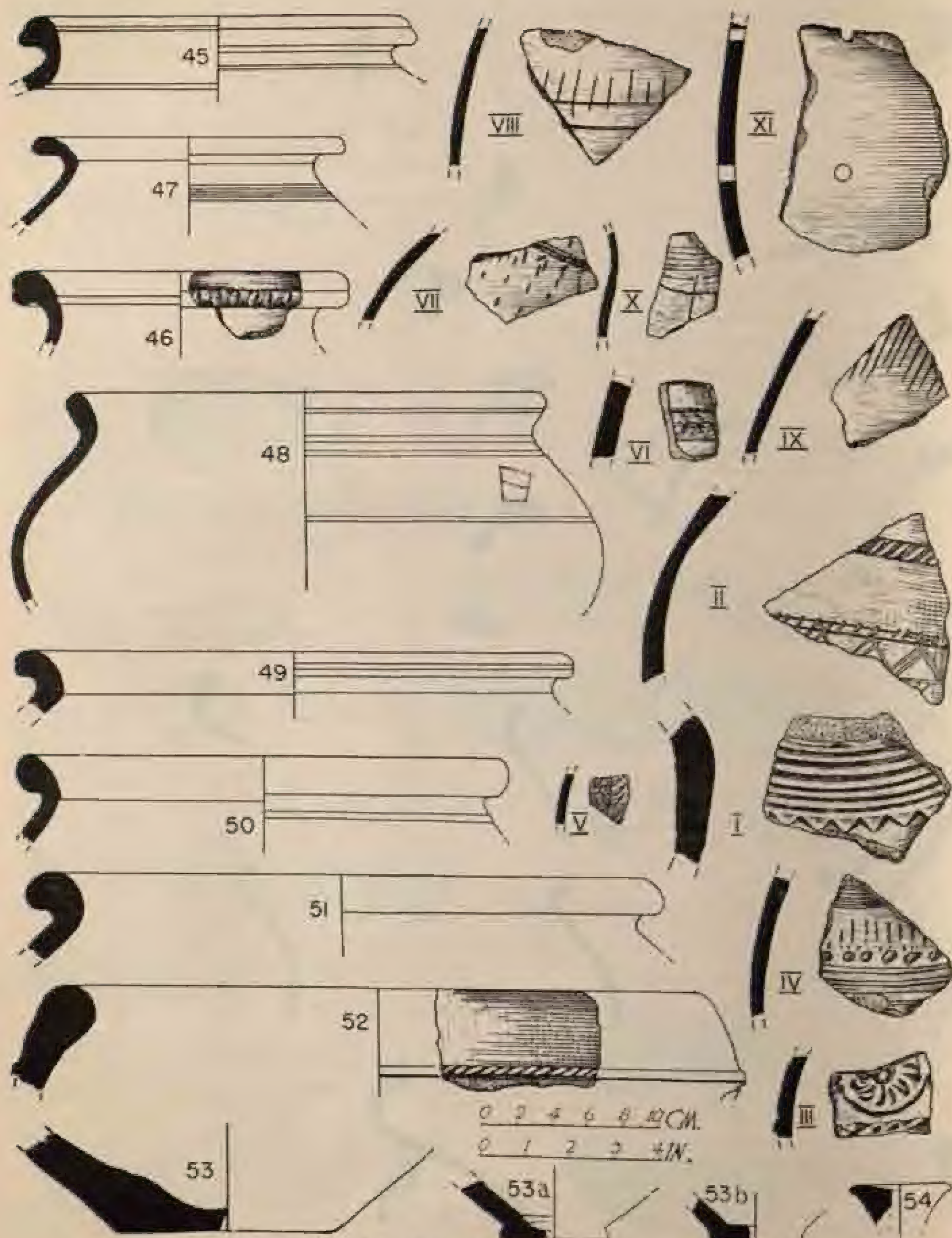


FIG. 10. *Pottery from Sub-period III A*

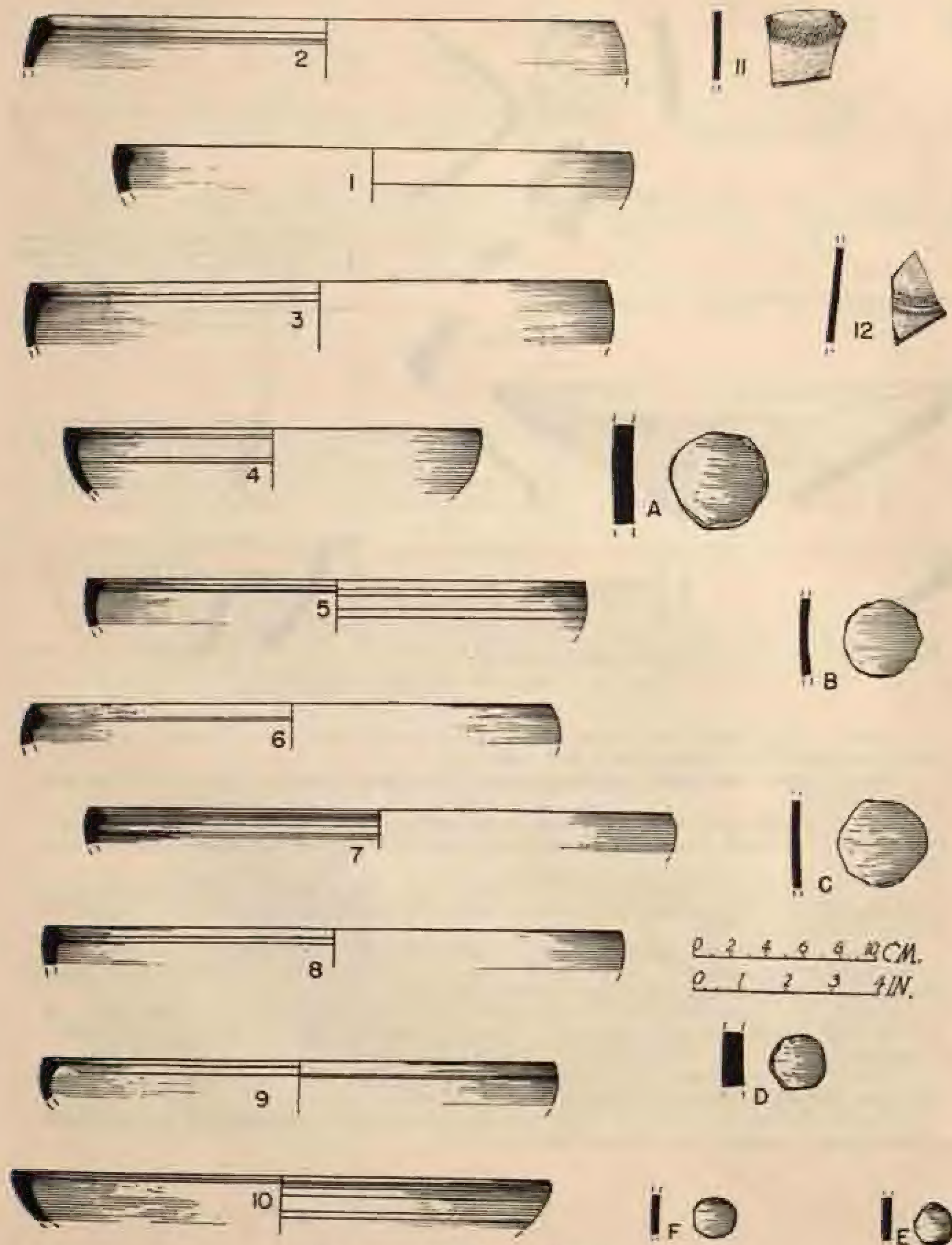


FIG. 11. Pottery from Sub-period III A

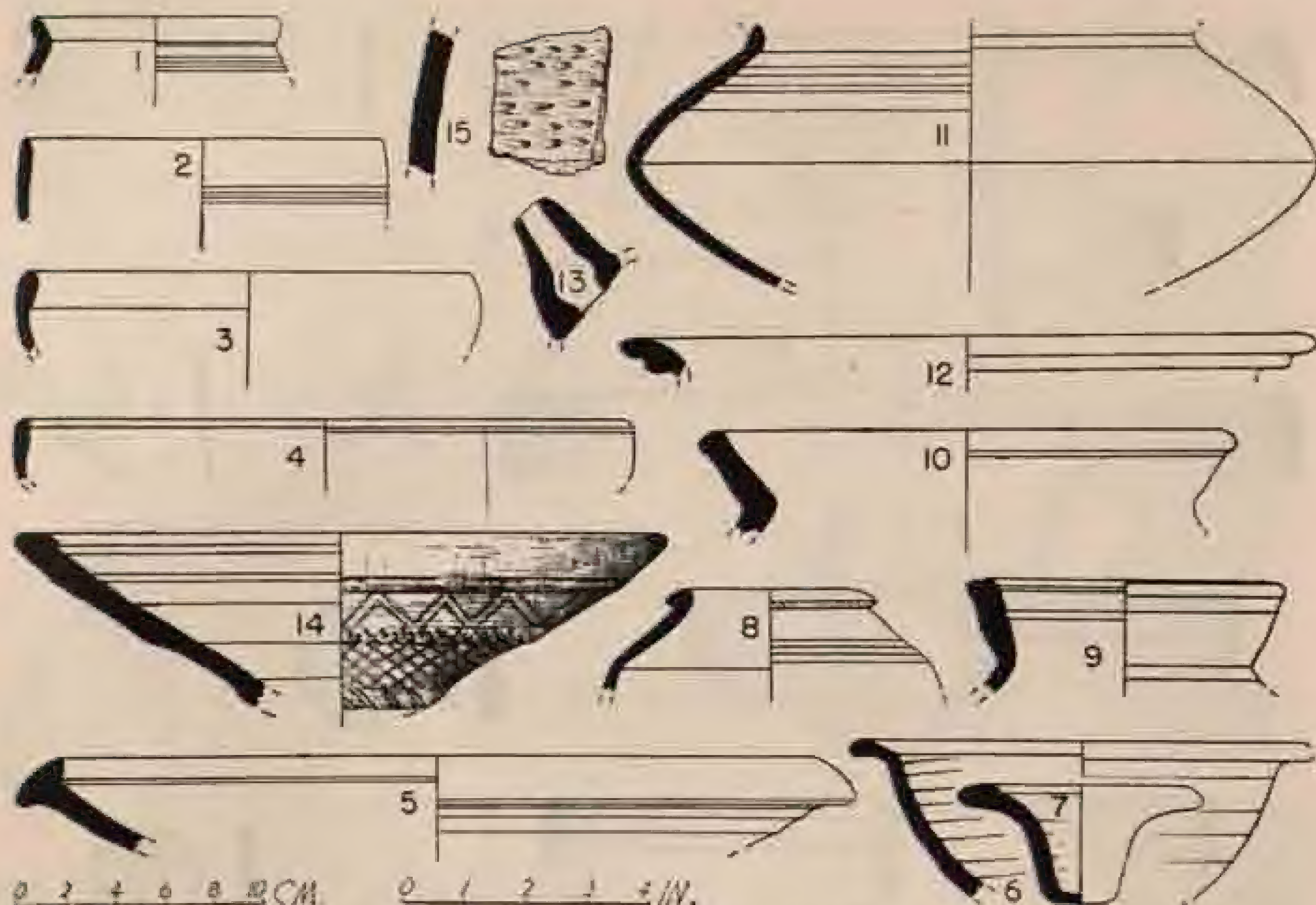


FIG. 12. *Pottery from Sub-period III B*

Type 2. Deep straight-sided bowl of black ware with grooves on the exterior. Of coarse fabric, it is treated with a black slip on both sides.

Type 3. Dish of black ware with incurved rim. Of coarse to medium fabric, it is treated with a thin black slip.

Type 4. Shallow dish of red ware with an obliquely-cut and grooved rim and straight sides. Of medium to fine fabric, it is uniformly fired and treated with a glossy reddish-brown slip on both sides.

Type 5. Lid-*cum*-dish of red ware with nail-head rim. The drooping exterior can rest on the rim of the cooking vessels. Of coarse to medium fabric, it is treated with a black slip on the interior and exterior below the rim.

Type 6. Lid-*cum*-bowl type of red ware. It might have been a cooking-vessel as is indicated by its soot-stained appearance. The wheel-grooves are prominent. Of coarse fabric, it is burnt grey in section and is treated with a red slip along the rim.

Type 7. Lid of red ware with a horizontally-splayed and collared rim for a good grip. Of medium fabric, it is treated with a red ware. It might have been used as a lid for some narrow-necked vase.

Type 8. Red ware vase with a mildly-carinated shoulder. Of medium fabric, it is treated with a red slip on the exterior and interior down to the neck.

Type 9. Red ware pot with a collared and grooved rim. Of coarse fabric, it is treated with a black slip on the exterior and interior down to the neck.

Type 10. Wide-mouthed red ware pot with a thickened rim and carinated neck on the interior for a lid to rest. Of coarse to medium fabric, it is treated with red slip on both sides and is burnt grey in section.

Type 11. Red ware carinated vessel meant for cooking. The lower half below the carination is completely soot-stained. Of coarse to medium fabric, it is burnt grey in section and is treated with a red slip on the exterior down to the carinated waist. The wheel-grooves are very prominent.

Type 12. Wide-mouthed jar with a splayed-out rim which is recessed on the exterior. Of coarse to medium fabric, it is burnt grey in section and treated with bright red slip on the exetrior only.

Type 13. Spout of red ware, treated with red slip.

Type 14. Unique red ware bowl profusely decorated on the exterior. Incised triangles between the raised bands—the lower one further notched with finger-nails—have an incised check-pattern over the finger-nail pattern on applied band.

Type 15. Jar of red ware carrying notched dots between the horizontal grooves. Of medium fabric, it is well-fired.

E. Period IV

(i) *General observations*

The pottery from the uppermost levels of this site consists of red, grey and black wares in order of frequency. It is mostly of coarse fabric, but a few instances of medium-to-fine fabric are also not wanting. The coarse grey ware of this Period resembles very much the early medieval ware from Nagarjunakonda, Yeleswaram, Dharanikota, etc.

(ii) *The types*

The following types are available: small-sized deep bowls (fig. 13, *1* and *2*); shallow and deep dishes (fig. 13, *3–7*); lids, which could also be used as bowls and dishes (fig. 13, *8–11*); medium-sized pots (fig. 13, *12* and *13*); cooking-vessels (fig. 13, *14–16*); vases (fig. 13, *17–19*); and troughs (figs. 13, *20* and *14*, *21–23*). The commonest types are *3*, *9*, *10* and *19*, besides decorated examples.

Fig. 13

Type 1. Black ware bowl with a thickened rim and multi-grooved exterior. Of coarse fabric, it is devoid of any slip.

Type 2. Black ware bowl with a sharpened rim and straight sides. Of coarse fabric, it appears to have been treated with a thin black slip, which has disappeared.

Type 3. Red ware dish with an internally thickened rim. Of medium to fine fabric, it is uniformly fired and treated with a thin reddish-brown slip on the interior.

Type 4. Dish with a mouth wider than the above and an internally-cut and grooved rim. Of medium fabric, it is indifferently fired and treated with brown slip on the interior.

Type 5. Dish, deeper than *3* and *4*, with a multi-grooved exterior. Of medium to fine fabric, it is treated with brown slip on the exterior.

Type 6. Dish of black-slipped ware. It differs from *4* in having a coarse fabric and a pair of deep grooves running around the neck.

Type 7. Dish of black-slipped ware with a flat rim and grooved exterior.

Type 8. Red ware lid-*cum*-dish with a mildly-carinated waist. Of coarse-to-medium fabric, it is well-fired and carries red wash on the interior and exterior down the waist.

Type 9. Lid-*cum*-bowl of coarse grey ware with a vertical side and prominently-flanged waist, which could rest on another pot. It is devoid of any slip.

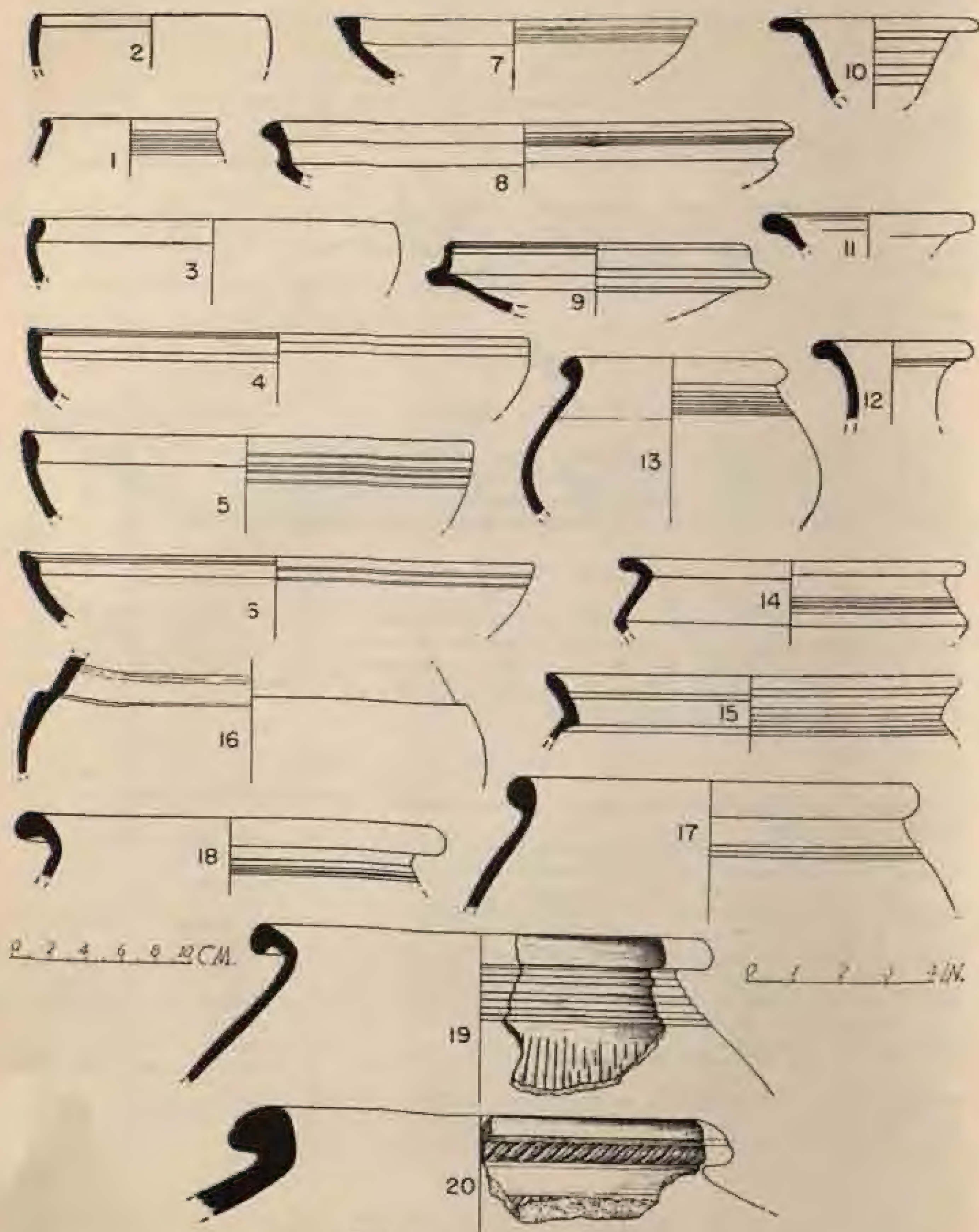


FIG. 13. *Pottery from Period IV*

Type 10. Deep lid of coarse red ware with a horizontally splayed-out rim for good grip. Striation-marks are prominent on the interior and grooves on the exterior. It is devoid of any slip.

Type 11. Rim-fragment of the type represented by *10.* Of medium fabric, it is well-fired and treated with red slip.

Type 12. Small-to-medium pot of red ware, with an elongated narrow neck and possibly a globular body. Of coarse-to-medium fabric, it is burnt grey and is treated with a dark-brown slip on the exterior only.

Type 13. A *loṭā* type with a thickened rim and grooved shoulder. Of coarse-to-medium fabric, it is uniformly fired and treated with a light-red slip on the exterior down to the waist.

Type 14. Carinated cooking-vessel of red ware with a completely soot-stained base of coarse to-medium fabric, it is devoid of any slip.

Type 15. Grey-ware cooking-vessel with sharply-carinated internal neck. Of coarse gritty fabric, it is devoid of any slip.

Type 16. Rare red ware vessel having a prominently-ledged shoulder for receiving lid (cf. *9*). Of medium to fine fabric, it is treated with a bright-red slip on the exterior.

Type 17. Red ware vase with an externally-thickened rim and expanding profile. Of coarse fabric, it is ill-fired and treated with a light-red slip down to the shoulder. This appears to have been placed on the oven for boiling milk or water or a similar purpose, as indicated by its soot-stained sides.

Type 18. A red ware vase with an externally-drooping rim and perhaps expanding shoulders. Of coarse fabric, it is unevenly fired and devoid of any slip.

Type 19. It is bigger than above and has multi-grooved shoulder above vertically-incised lines. Of coarse gritty fabric, it is treated with a light red slip on the exterior.

Type 20. A thick red ware trough with an externally-thickened rim, decorated with a finger nail pattern. Of coarse red ware, it is burnt black in section and treated with a bright red slip on the exterior.

FIG. 14

Type 21. Trough with a wide mouth, externally-thickened rim and multi-grooved shoulder. Of coarse red ware, it is uniformly fired and treated with a light-red slip on the exterior and interior up to the neck.

Type 22. Trough with an externally-collared rim and widening sides. Of coarse gritty fabric, it is uniformly fired and treated with a bright red slip on the exterior and interior up to the rim.

Type 23. It is the largest trough and has incurved and externally-prominent collared rim. Of coarse red ware, it is burnt black in section and treated with a red slip on the exterior alone.

(iii) *Decorated pottery*

The following are the typical decorations on pots, all recovered in fragments.

I. Red ware fragment of jar, having incised decorations of oblique strokes and six-petalled lotus on one side and shooting leaves with stems on the lower half.

II. Red ware shoulder-fragment with incised herring-bone design over the eight-petalled incised lotus, from which the loops are shooting on one side.

III. Red ware sherd with incised oblique strokes between incised grooves.

IV. Red ware sherd with decorated incised pairs of triangles in rows between the notched strokes.

V. Red ware sherd with twisted-rope pattern.

VI. Red ware sherd with applied bands bearing finger-tip and rope patterns.

VII. Thick red ware sherd with applied band of finger-tip design.

VIII. Red ware sherd having rows of oblique incisions on the body.

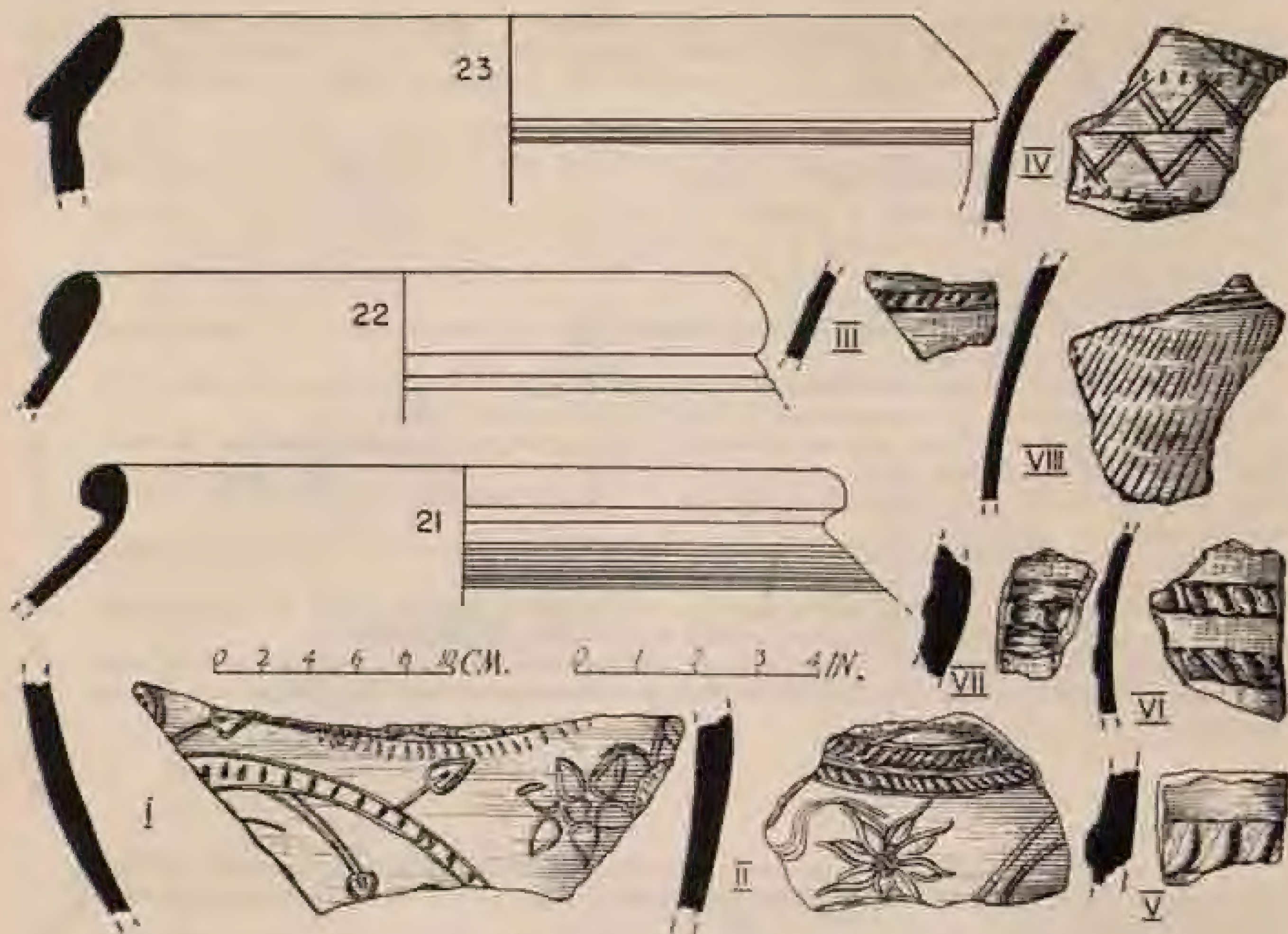


Fig. 14. *Pottery from Period IV*

11. OTHER SMALL FINDS

The small finds from Kesarapalle recovered either in excavation or on the surface may be described under the following seven heads: neolithic polished stone axes, beads, terracotta objects, metal objects, bone and shell objects, stone objects, and pottery discs.

A. Neolithic polished stone axes

Both the specimens, from the surface, are without any pointed butt and are roughly trapezoid in outline. Specimen 1 (pl. XXIII A), measuring 8·1×6·2 cm., is a fully-polished example on trap with lenticular medial cross-section and slightly-convex cutting-edge; butt-end, though thin, is also slightly convex. It is an evolved specimen without any parallel in the neolithic assemblage of Nagarjunakonda. The other specimen, 2 (pl. XXIII B) is made of granite and measures 8·3×6·2 cm. Polishing on it does not extend beyond the cutting-edge which has a greater convexity than the



A. *Kesarapalle: neolithic tool from surface. See p. 72*



B. *Kesarapalle: neolithic tool from surface. See p. 72*



A. *Kesarapalle: beads and terracotta objects. See p. 73*



B. *Kesarapalle: an iron ring and terracotta conical objects.*
See pp. 73 and 74



A. *Kesarapalle: metal and stone objects.* *See p. 74*



B. *Kesarapalle: objects of bone, shell and iron.* *See p. 74*

To face pl. XXIV



A. *Nagarjunakonda: megalithic burial pit.* *See p. 49*



B. *Motadaka: general view of megaliths.* *See p. 48*

former. With a roughly elliptical cross-section it has a splayed-out lower half and a blunted butt-end.

B. Beads

Altogether fourteen beads, besides six from the surface, were discovered from the excavation. Terracotta, stone, bone and copper formed the primary bead-material. The one in copper is of cylinder-circular type coming from Period II. Of the six specimens of spherical beads, five are made of stone, while one from the surface, is of terracotta: this shape was confined only to Periods II and III. A terracotta spacer, oblong in shape with four horizontal perforations, came from the late levels of Period I and had its analogue in bone recovered from Period II. No glass bead was encountered in the excavation; the solitary specimen of long-cylinder-circular bead of green translucent glass came from the surface. Stone beads conform to two shapes only, viz., spherical and barrel-cylinder-circular. A cylinder-square specimen of lapis lazuli, recovered from Period III, shows a perforation in the centre, suggesting its use as a pendant. There are two specimens of barrel-circular-cylinder bead, one of jasper and the other, an unpierced one, of terracotta; the former came from Period II. Thus, while Period I yielded only one terracotta spacer, the megalithic levels produced not only a spacer but also types like barrel-circular, cylinder-circular and spherical beads.

The following selected specimens are illustrated:—

Pl. XXIV A

2. Jasper; barrel-circular-cylinder. From KSP-2, Period III A.

3. Lapis lazuli; cylinder-square with a central perforation. From KSP-2, Period III A.

4. Rock-crystal; spherical. From KSP-2, Period II.

5. Terracotta; spacer-bead with four horizontal perforations parallel to each other. From KSP-1, late level of Period I.

7. Terracotta; pear-shaped. From KSP-2, Period III B.

8. Terracotta; cylinder-circular, unpierced. From KSP-2, Period II.

9. Carnelian; spherical. From KSP-2, Period III A.

C. Terracotta objects

The total number of terracotta objects obtained in the excavation was only four but functional value of all these specimens is difficult to guess. These may be divided into two groups, viz., cones and rings, the latter variety being confined to Period II only. The conical terracotta object, from Period I, has a defined base with a perforation thereon for suspension (pl. XXIV B, *3*). It represents a phallic symbol which could have been used as an amulet or pendant. No arrangement for suspension is, however, noticed in the other example (pl. XXIV B, *2*) collected from the megalithic burial. The terracotta rings, annular in shape, are common in the finds of the megalithic burials; pl. XXIV A, *1* and *6*, may even be called as whorl bead on the analogy of Brahmagiri, although the necessity of providing such big holes in a bead cannot be explained easily.

D. Metal objects

The number of iron pieces, mostly of indeterminate shape, is about fifteen of which three specimens—one spear-head (pl. XXV A, *2*) a wedge (pl. XXV A, *1*) and a piece of indefinite shape—came from the area of megalithic burial. A fragment of spear-head (pl. XXV A, *3*), was recovered in regular excavation from Period II. The most common type in the historical level is a nail with bent head. An iron ring (pl. XXIV B, *1*) of indefinite use and a bangle (pl. XXV B, *6*) were obtained from Sub-period III A.

Besides the lead coin referred to earlier (above, p. 52), two copper specimens excluding the bead (above, p. 73) mentioned above, were found in Period III. One of them is a small rectangular piece and the other a ring, represented by two fragments.

E. Bone and shell objects

Mention has already been made (p. 43) of the occurrence of a bone spacer-bead (pl. XXIV A, *5*) in Period II. Other finds of this group comprise shell bangles (pl. XXV B, *2* and *4*) and two bone points (pl. XXV B, *1* and *3*) belonging to Period I. One of the last-mentioned specimens has a sharp pointed end and a polished surface. Shell-bangles and rings came only from Period III.

F. Stone objects

This group includes a stone dabber (pl. XXV A, *4*) from the surface and a colour-grinder (pl. XXV B, *5*) from Period II, both being potter's artefacts.

G. Pottery discs

The group formed the bulk of the finds in the excavation and occurred in all Periods. A total number of twenty-nine specimens of circular pottery discs were discovered, ranging in diameter from 20 to 52 mm., the maximum concentration being in the group varying from 30 to 39 mm. (ten specimens) and from 40 to 49 mm. (twelve specimens). There are four examples with a diameter of 33 mm., three of them coming from Period I. Besides circular ones, two oblate specimens were also noticed. Such unpierced discs are of uncertain use (above, p. 63), though generally these are identified as gaming-counters used by children in games like hopscotch (fig. 11, *A* to *F*).

[*Received on the 2nd March, 1965,–Ed.*]

PREHISTORIC EXPLORATION IN KATMANDU VALLEY, NEPAL

By Dr. R. V. Joshi

CONTENTS

1. INTRODUCTION

In response to a proposal from the Indian Mission in Nepal, Shri A. Ghosh, the then Director General of Archaeology in India was deputed in May-June 1960 to advise His Majesty's Government on the re-organization of their Department of Archaeology. Of the many recommendations, which Shri Ghosh made after his fortnight's stay in Nepal, those relating to prehistoric investigation and Pleistocene geology were highly significant, for nothing in that direction had till then been done in Nepal. The present author, therefore, undertook this work subsequently during September–October 1961 on behalf of the Archaeological Survey of India.

The geographical situation of the Katmandu valley in Nepal within the latitudes 27° 42′ and 27° 45′ N and longitudes 85° 15′ and 85° 30′ E, its altitude of about 1500 m. above the sea-level, its genial climate of the type intermediate between the humid sub-tropical and microthermal of the Central Himalayan region, with an average maximum temperature around 10° to 25° centigrade and an average annual rainfall of about 1450 mm.,[1] an ample supply of water from several perennial streams, and the forest-covers all along the surrounding hills, make it a congenial environment for human settlements. No wonder that the maximum concentration of Nepal's present population is in this valley.[2] If the same environmental conditions had prevailed in the Pleistocene period, the valley might have attracted the early human settlers of the Stone Age.

It may be mentioned here that the northernmost Stone Age sites in the Indo-Pakistan sub-continent occur between the latitudes of 33° and 34° N in the valleys of the Indus in West Pakistan (sites in the Soan valley in the Potwar region); and in India in the valleys of the Sutlej (sites on the Sirsa), and the Beas (sites on the Banganga). These sites lie close to the Siwalik-formations, which range in age from Miocene to Middle Pleistocene. Of the three sub-divisions of the Siwaliks, the lower and the middle groups

[1] Pradyumna P. Karan, *Nepal, A Physical and Cultural Geography* (Lexington, 1960), pp. 25–33.
[2] *Ibid.*, pp. 48–49.

yield fossils of mammals, particularly those of the anthropoids or apes while the topmost beds are non-fossiliferous.[1] The Siwalik region as well as those covered by the later geological formations (Holocene) are naturally promising areas for tracing the early human remains.[2] Now since the same geological formations (the Siwaliks) continue in the Nepal territory also, the survey of the latter was a desideratum. With this aim and to initiate systematic archaeological survey in Nepal, a preliminary prehistoric exploration of the Katmandu valley was sponsored by the Government of Nepal through the Indian Co-operation Mission, in Nepal and the author undertook this work in the months of September and October, 1961.



Fig. 1.

[1]D. N. Wadia, *Geology of India* (London, 1953), pp. 368–72.
[2]H. D. Sankalia, *Prehistory and Protohistory in India and Pakistan* (Bombay, 1962), p. 1.

2. PHYSICAL FEATURES

The Katmandu valley, which is surrounded by the Mahabharat and associated ranges of the Middle Himalayas is a tectonic valley (pl. XXVII) in the form of a synclinal trough enclosed between two continguous antclinal flexures.[1] It is somewhat modified by the deep alluvium, mostly composed of clays and sands, which, at places, reaches to a depth of more than 200-350 m.[2] The underlying geological formations are the crystalline rocks of different periods.[3]

By the network of several small tributaries the two major rivers—the Bagmati and the Manohara—drain the Katmandu valley (pl. XXVIII) and their waters are finally discharged by the Bagmati through the deep gorge in the Mahabharat range in the south. These streams originate in the neighbouring hill-ranges and traverse only short distances (fig. 1). The large volume of water released during the rainy season from July to September, causes erosion in the stream-valleys, as a result of which, as well as due to tectonic action, a series of alluvial terraces have been cut in the deep alluvium of which, from the highest point on way to Tika Bhairab, as many as four terrace-levels were noticed flanking the river-valleys.[4] But generally two surfaces at contours 4,300 ft. (1350·64 m.), and 4,500 ft. (1371·6 m.) respectively are conspicuous in their areal expanse and clear-cut cliff sections. It is interesting to note that a large number of villages in the valley are situated on these flats.

3. THE DEPOSITS

Generally the deposits underlying such river-terraces contain prehistoric material left by the people who may have settled over them in the past. A detailed examination was, therefore, undertaken of the terrace-deposits exposed in the cliff-sections as well as of the loose river-gravels.

The gravel in the river-beds and the sections is made up of a mixture of sub-angular and rolled blocks of granite, granite-gneiss, schistose rocks, pegmatites and vein quartz, etc. Besides this rock material, the southern streams contain pebbles of limestone and quartzite. Excepting the schistose rocks, all this raw material is suitable for making stone tools. But so far stone artefacts, either of palaeolithic or microlithic type, have not been found within this valley. Two or three specimens (pl. XXIX A and B) collected from the Godavari river near Balkhu are extremely doubtful and not at all convincing to establish the presence of Early Man in the valley.

In the absence of the archaeological remains the study of these deposits would be purely of geological interest. But it should be mentioned here that even the Kashmir Basin has not yielded any prehistoric lithic remains within that valley. The geological study of its deposits like the *Karewa* clays and gravels, however, provided important clues for linking the terrace-sequence and the associated Stone Age industries of the Soan basin in the Potwar Plateau in West Pakistan and for establishing the relation of the

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[1]D. N. Wadia, *op. cit.*, p. 432. Toni Hagen, a Swiss geologist, who has explored Nepal, has elaborately described the mechanism of this tectonic disturbance. See, Toni Hagen, *Nepal*, Geographical Publishers (Berne, 1960), p. 50.

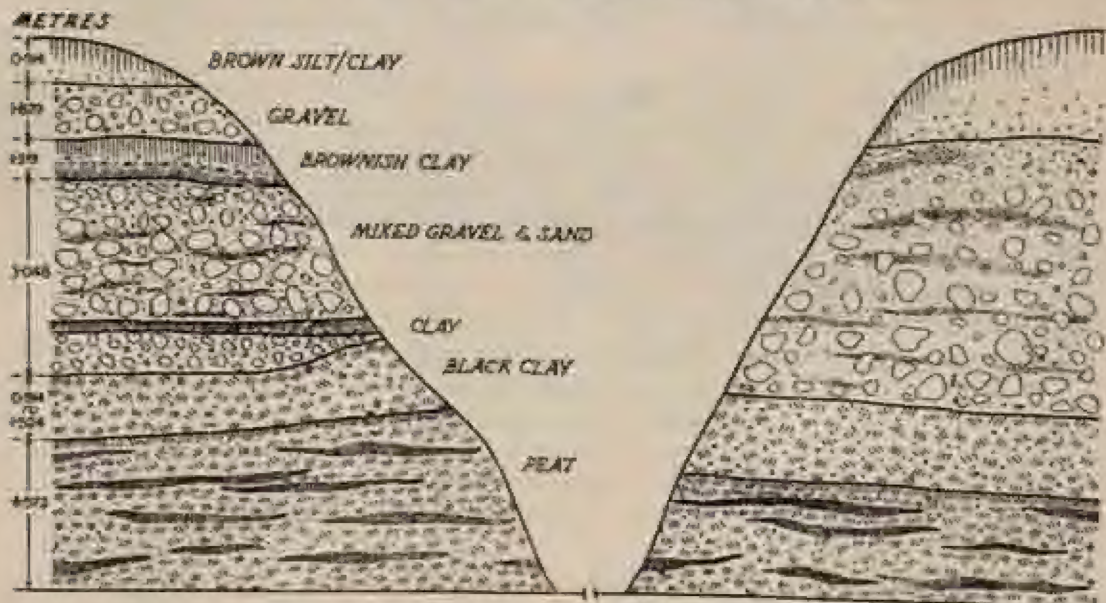
[2]Information from Toni Hagen.

[3]P. P. Karan, *op. cit.*, pp. 20-21.

[4]The tablelands (terraces) are called the '*Tars*' and the valleys, the '*Kholas*'. See, Munshi Shew Shankar Singh and Pandit Gunanand, *History of Nepal* (1877). But in the survey maps the word *Khola* has been often used to mean a stream.



SECTION ACROSS KHWAJA KHOLA



SECTION ACROSS LUTE KHOLA

FIG. 2.



Bagmati river flanked by high alluvial terraces with the Mahabharat range in the background. *See p. 77*



A view of the Katmandu valley with Bagmati river and alluvial terraces from Chaubhar. *See p. 77*

To face pl. XXIX



A. *Katmandu, Nepal: chopper-like implement.* *See p. 77*



B. *Katmandu, Nepal: discoidal core.* *See p. 77*

To face pl. XXVIII



Finely banded clays from a section near Sitapakha. *See p. 79*



A section on the Khwaja Khola showing gravel and clay-beds. *See p. 79*



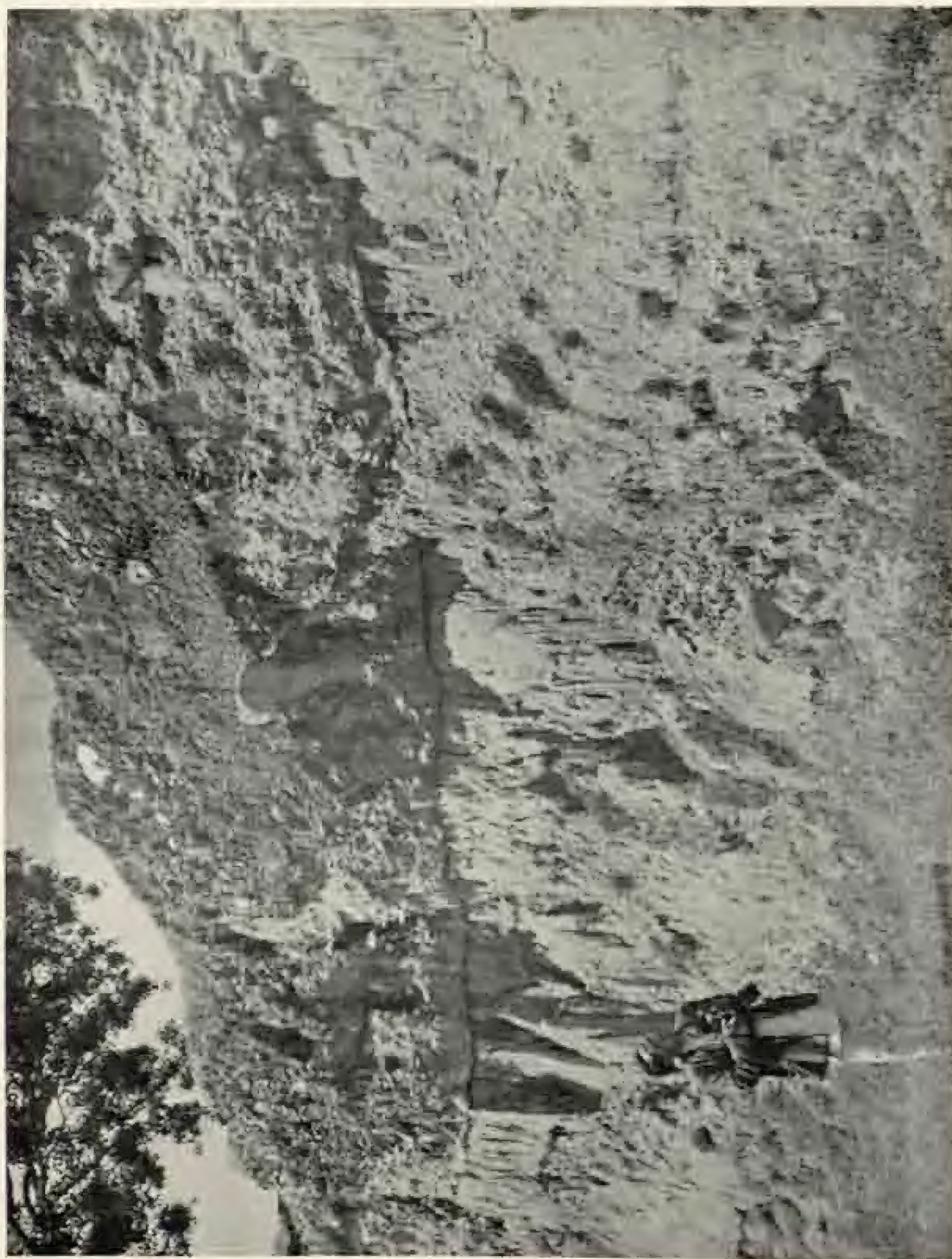
The section on the Lute Khola showing partly-concealed beds of gravel and clay. The central figure on the slope is near the peat-bed. *See p. 79*

To face pl. XXXIII



High clay cliffs with one or two thin peat-beds on way to Sankhu. *See p. 79*

To face pl. XXXII



Talus section on the road between Pharping and Dakshinkali. *See p. 80*

terraces with the glacial and interglacial phases of the Pleistocene Ice Age as worked out in the Kashmir valley.[1] It is, therefore, necessary to verify the results of similar studies in the Kashmir basin and to prepare suitable background for the future discoveries of the Stone Age relics in the territory of Nepal.

The alluvial deposits exposed on the nullah sections and the loose gravel spreads in the river-beds were examined at all the places wherever it was possible, for, in this season the rivers had flood-waters and most of the banks were either water-logged or covered by paddy crops. Inspite of these limitations in the detailed scrutiny of the material all the necessary care was taken to have a thorough probe in this valley.

Beautiful sections of the terrace-level corresponding approximately to 4,300 ft. (1310·64 m.) contour are exposed near Bungamati, Sitapakha (pl. XXX) Sainbhu and Lalitpur in the south of Katmandu town. At Sitapakha, the cliff facing the Kodku river valley showed a bed of 1·5 to 3 m. loosely cemented gravel resting on a finely laminated brownish clay 3 to 4·5 m. thick. In the road section, north of the village Sainbhu and not far from the Nakhukhola bed, the gravel was 6 m. thick and partially cemented, while in the road cutting on way to Patan (Lalitpur) from Katmandu, excellent sections of the clays were noticed. This clay which was found usually underlying the gravel is very finely banded and recalls the varved clays deposited by melt-water of ice in the lake beds at the outer margin of glacial outwash.

West of Katmandu, at the starting point of the trolly-line in the Khwaja Khola, a fine section (pl. XXXI) was seen facing the east. This corresponds approximately to 4,500 ft. (1371·6 m.) contour terrace. From top to bottom the section had exposed a 60 cm. silt covered by a thin humus, 1·5 m. loose and weathered gravel, 3 m. fine sand and another bed of 1·5 m. somewhat cemented gravel, and finally a thick deposit of bluish-green sand, a part of which was concealed under the huge talus accumulation. All these different deposits were more or less conformable with each other (fig. 2, pl. XXXI).

The sections in the Lute Khola (pl. XXXII) near Chapaligaon to the north of Katmandu and also those exposed around Gokarn and on the road leading to Sankhu (pl. XXXIII) in the east are interesting as in them were noticed one or two peat-beds intervened between the gravel, sand, and clay beds. In the Lute Khola, the section (fig. 2), from the nullah-bed upwards, was made up of 4·5 m. fine sand and clay, 1·5 m. black organic earth (peat); 3 m. mixed gravel and sand with little clay, and at the top 1 m. brown silty clay. The peat-bed is variable in thickness and slightly dipping towards the opposite bank.

The banded structure of the sediments clearly indicates their formation under water action. The finely laminated clays and some sand-beds point to their deposition in a still water like in the lake basins. The unsorted character of gravel components in some sections is due to their rapid deposition possibly in the shallow waters. The peat-beds and organic earth show the existence of marshy conditions or bog formations. The palaeobotanical studies of the peat samples may throw light on the nature of the prehistoric vegetation of this region.

4. DISCUSSION

To sum up, it may be said of these deposits that they represent water-laid sediments mostly formed in quiet waters such as in the lake-basins. The banded clays generally

[1]H. de Terra and T. T. Paterson, *Studies on the Ice Age in India and Associated Human Cultures* (Washington, 1939), pp. 279–93.

do not show plications or disturbance of laminae[1] and perhaps recall the varve-like features formed by the precipitation of fine detritus carried by melt-water of glaciers. The survey of the neighbouring hill-flanks, which cannot be considered as thorough due to heavy vegetation and wet surface, did not reveal any morainic deposits. In the exposed sections within the valley also no moraine was seen underlying the alluvial material. The débris section, near Pharping (pl. XXXIV) in the south, composed of subangular and angular fragments of varied dimensions and mixed with clay appears to be a talus or soil creep along the steep-slopes. Such material is often formed by solifluxion processes. It was learnt that the borings taken in some parts of this valley had penetrated through well over 210 m. of sand and clay beds without encountering coarser sediments or the solid rock.

The morphological structure of the valley as enclosed within the high mountain ranges is well-suited for the formation of a large lake or several small lakes in which the sediments described above could have found a place.

The precise geological age of the formation of this valley and its alluvial deposits cannot be defined, as yet, with certainty. The latter may have been formed in the last Glacial or post-Glacial period.[2] The absence of any kind of prehistoric relics in the valley so far surveyed perhaps also points to its comparatively recent geological age, although such archaeological evidence even in a negative form should not be used for estimating the age of a geological deposit.

A small cave was noticed in the cherty limestone about 4 m. above the water-level on the right bank of the Bagmati near Chobbar. However, it did not yield any cultural deposit, nor were any tools found inside or in its neighbourhood. It will be advantageous to explore the caves that may be existing in other parts of Nepal for they may have provided shelters for early humans in this cold Himalayan country.

The limited search for prehistoric remains in the country of Nepal did not turn out fruitful. But it must be mentioned here that the area surveyed so far is about one per cent of the total area of about 1,40,000 sq. km. of Nepal, and although a major portion of the latter will have to be excluded as being mountainous, heavily forested or marshy lands, there is still a sizable portion of this country that awaits exploration and until it is done it will not be proper to say that this country has no prehistoric past.

The example of the Kashmir Basin may again be cited here. This valley has at least yielded the glacial deposits in the valleys of the tributaries of the Jhelum, viz., the Liddar and the Sind. It is, therefore, necessary to explore some more areas of Nepal, particularly the Pokhara region in the north for the post-glacial evidence; the Thak Khola and Mushtang region for caves;[3] the lower course of the Bagmati, particularly where it emerges through the Mahabharat range and enters the Siwalik hills, for the Stone Age sites. It may be fruitful if a similar survey is carried out in the Rapti (the river which rises near Hitauda), and in the Narayani (near Bharatpur) as their basins are fairly wide and at lower altitudes and also have suitable natural environment for human settlements.

[1]Toni Hagen has noticed the dipping of these sedimentary deposits towards south, *op. cit.*, p. 50.

[2]Toni Hagen has, however, given a rough estimate that the lake of Katmandu dried up about 200,000 years ago and in the subsequent orogenic movement it was raised by at least 200 metres. See, Toni Hagen, *op. cit.*, pp. 50–53. But the basis of this estimate of age has not been given by him. See Post-script at the end (p. 81).

[3]Toni Hagen, *op. cit.*, p. 57.

It is suggested here that since the two major projects on the Kosi and the Gandki rivers in Nepal region are under way, it will be very beneficial if early steps are taken for rapidly traversing the region, which is likely to go permanently under water.

The Soan Valley in West Pakistan has yielded distinct Early Stone Age industries characterized by pebble tools comprising choppers and chopping tools. Although the implements of handaxe category are also present in the Soan Valley, this region of Pakistan is considered to be a type-area of 'chopper-chopping complex' identified by the site name as the Soan culture. Besides the Soan Valley, this type of culture-complex has been reported from Burma (Anyathian culture), Malaya (Tampanian culture), Java (Patjitanian culture), and Northern China (Choukoutien culture),[1] i.e., from the countries situated to the south, east and north of Nepal.

If this 'chopper-chopping complex' is considered to be a distinct culture and its spread in the above-mentioned countries is to be explained as by migration, then it is unlikely that Nepal, which is centrally situated in this vast Asian region, remained free from any impact of this culture. This culture might have entered the Nepal territory by several routes through the Terai region in the south or by the mountain passes in the north.[2]

In peninsular India and at some sites in Pakistan the dominant Early Stone Age industries are of the handaxe category. Such sites occur in the region not far away from the southern boundaries of Nepal. But no tools of this category are yet found in Nepal. Whether these two Early Stone Age traditions reached Nepal can only be proved by further explorations.

5. ACKNOWLEDGEMENTS

The author is grateful to the Government of India for deputing him to conduct the prehistoric investigations in the Katmandu valley and to His Majesty's Government of Nepal for providing all facilities in this work. Shri A. Ghosh, Director General of Archaeology in India and Shri S. S. Bhandarkar, Education member, Indian Co-operation Mission in Nepal took special interest in this work and offered valuable suggestions. Shri Maski, ex-Director of Archaeology in the H. M. Government of Nepal placed his staff at the disposal of the author and also joined the exploration party on one occasion. Shri Kulshekhar Sharma, Secretary, Ministry of Education, His Majesty's Government of Nepal, did everything possible to facilitate work and to expedite the official arrangements in this regard. Shri Janak Lal Sharma, of the Archaeology Department of His Majesty's Government of Nepal accompanied the party at all times and worked as a very valuable guide. The author's sincerest thanks are due to all of them. The author also acknowledges the assistance rendered in this work by Shri E. R. Sathe (Surveyor) and Shri M. U. Qureshi (Photographer), of the Prehistory Branch of the Archaeological Survey of India.

POST-SCRIPT

1. The radiocarbon date of the peat-sample from naturally exposed road-cutting on way to Sankhu has been found to be $29115 {}^{+3220}_{-2285} \left(29960 {}^{+3315}_{-2350}\right)$ years B.P. as determined by the Tata Institute of Fundamental Research, Bombay. Thus this peat-

[1]Cheng Te K'Un, *Archaeology in China*, vol. I, Prehistoric China (Cambridge, 1959).
[2]P. P. Karan, *op. cit.*, Map No. 34, p. 87.

sample seems to be of late Pleistocene age (D. P. Agrawal and Sheela Kusumgar, 'Radiocarbon dates of some prehistoric and Pleistocene samples', *Current Science*, 36, No. 21, November 5, 1967, pp. 566–568).

2. Basing on the suggestion contained in the above report of the present author, the Department of Archaeology, His Majesty's Government of Nepal, under the leadership of Dr. N. R. Banerjee, Archaeological Adviser, Indian Co-operation Mission in Nepal, carried out prehistoric exploration in the Narayani Basin when some Early Stone Age tools were found, at a site Dandi. The party also observed high-level terraces in this valley. (N. R. Banerjee, "Discovery of the Remains of Prehistoric Man in Nepal", *Ancient Nepal*, no. 6 (1969), pp. 6-9.)

[*Received on the 21st April, 1964,–Ed.*]

PRESERVATION OF MURAL PAINTINGS

By Dr. B. B. Lal

CONTENTS

1. GENERAL

A large number of ancient and historical monuments are embellished with mural paintings and their preservation presents extremely difficult problems. Consequently, not only is it necessary to maintain a constant vigil on these works of art, but the problems of their preservation have also to be carefully studied for evolving suitable methods for their conservation. The most favourable environmental conditions for proper preservation of paintings are an average temperature of 20°c with only minor fluctuations, a relative humidity of 60%, effective ventilation for preventing stagnation of moist air and freedom of air from dust and other impurities.

The preservation of paintings presupposes not only a clear understanding of the artists' methods and materials, but also the behaviour of these materials under varying conditions of humidity and temperature. The first step in the chemical conservation of paintings is, therefore, the study of the methods and materials employed in their execution.

The main constituents which comprise a painting are the 'carrier', the 'ground', the pigment and the binding medium. In order to assess the deleterious effects of marked changes in temperature and relative humidity on paintings, be they on wall, canvas, paper or other support, each of these factors has to be studied in detail and its behaviour-pattern determined by careful examination and chemical analysis. Mural paintings are particularly susceptible to the deleterious effects of excessive heat and moisture on account of their location; consequently, their preservation is a complicated matter. The preservation of oil paintings and miniatures is equally complicated, but, being portable, they can be kept in museums under controlled conditions of humidity and temperature. It is, therefore, necessary to bear in mind the fundamental difference between preservation of paintings in museums, where relative humidity and temperature can be carefully controlled, and the preservation of paintings in monuments, where no such control is practicable.

A systematic scientific study has been conducted with a view to determining the nature of materials used in the execution of mural paintings. The pigments have been analysed, the composition of plaster has been determined and the nature of binding media ascertained by chemical analysis. For the study of binding media, the technique of chromatography has been found to be very useful. This technique helps in the identification of egg, glue and oil media in old paintings.

2. DAMAGE CAUSED BY MOISTURE

On account of relatively hot and humid conditions, many murals have suffered enormous damage, for all their constituents—the 'carrier', the 'ground', the pigment and the binding medium—have been adversely affected in varying degrees. The paintings done in the fresco technique are normally not affected by water, but most of the murals on the ancient and historical monuments are tempera and they are extremely susceptible to the harmful effects of moisture. As a result of moisture action, the painted plaster has, in some cases, lost its hold on the wall or the ceiling; in most cases, the binding medium has perished and the pigments have developed a tendency to flaking.

Stagnant humid air breeds insects; not a few paintings have sustained extensive damage due to depredations by insect pests. Insect nests, wax and carcasses have caused much damage to painted surfaces. In some cases, the paintings have been found to be suffering from chalkiness and 'bloom' which is a surface effect strongly influenced by humidity. Paintings done in resin medium show extensive wrinkling and blistering, for the organic resin has suffered oxidation and lost its binding power. In other cases, the varnish applied in the past for the preservation of some paintings has yellowed or darkened, obliterating the pigments or altering their optical character. A wet plaster is generally found to be covered with algal growth and instances of murals having suffered damage on account of algae are not wanting. Blistering and flaking of the pigments and the 'ground' are also caused by excessive movement of the 'carrier'. Displacement of members of stone or brick masonry, which constitute the 'ground' in many cases, leads to flaking of painted plaster. Such defects may be either due to the alternate expansion and contraction of the building materials or to excessive and violent changes in temperature.

Some paintings have deteriorated on account of the action of water-soluble salts, which accumulate on the surface of the painted plaster when the air is very dry. This salt-efflorescence is caused by the movement of water across the masonry.

In order that the pigments and plaster may hold, the 'carrier' should be quite dry and free from marked expansion and contraction. Moreover, it should have a tooth so that the bond between it and the plaster is firm. Many cave-temples with paintings have a rough stone surface which serves as the 'carrier'. The paintings in the rock-cut caves at Ajanta, Ellora, Śittannavāsal and Bāgh have been affected by moisture. The clearance of jungle from the exposed surface of the rock above the caves and the removal of decayed and spongy rock, without taking timely and effective measures by water-tightening the exposed surface, may result in perceptible movement of moisture inside the caves. The paintings at Bāgh and some paintings in Caves 16 and 17 at Ajanta show incipient deterioration on account of moisture, which has evidently found its way into the painted plaster due to seepage through the decayed and spongy rock. Some paintings at Śittannavāsal and Ellora have also suffered damage on account of moisture. The paintings at Bāgh have suffered damage due to copious percolation of water into the caves. The moisture may cause irretrievable damage to the paintings, unless urgent and effective steps are taken to prevent the ingress of water into the caves. The presence of moisture not only results in the loosening of the plaster and its eventual separation from the 'carrier', but its movement to the surface of the paintings across the rock or masonry also causes salt-efflorescence with its attendant destructive action on painted surfaces. Such a problem calls for effective structural repairs, followed by the consolidation of loose plaster and priming and the fixation of pigments.

The study of 'bloom' or chalkiness on Indian paintings has revealed a marked influence of humidity and rate of evaporation of solvents employed in eliminating old darkened varnish and other accretions. Ammonium sulphate, which has been found to cause 'bloom' in Western countries, could not be identified on the painted surfaces in India. Due to unsatisfactory conditions of relative humidity and temperature even in museums, where environmental conditions are better controlled than in large exposed monuments, damage to paintings has sometimes been extensive and sudden. It is interesting to record that in the winter of 1955-56, about a dozen cracked panels were reported in one week in the National Gallery, London.[1] For proper protection of paintings against the vicissitudes of tropical climate, a suitable system of air-purification with controlled temperature and relative humidity is the first essential. The rehabilitation of deteriorating paintings and the maintenance of disintegrating paintings for posterity under tropical conditions not only demand the highest standard of craftsmanship and an assiduous application of latest researches in science to their conservation, but they also call for a suitable environment which would not adversely affect the pigments, the media, the plaster and the support.

3. DAMAGE CAUSED BY INSECT PESTS

The corners, crevices and hollows in old broken painted surfaces are generally found infested with insects. Moist stagnant air, lack of ventilation and absence of an appreciable amount of diffused daylight aggravate the injurious effects of insect pests, and a suitable conditioning of air is called for to reduce this menace. For eradication of this malady, all insect nests are destroyed mechanically and those lodged in deep crevices, pits and hollows in painted plaster are removed by cautiously blowing dry air through them.

[1] *The National Gallery, January, 1955–June, 1956* (London, 1956).

There are many insecticides and insect-repellants, but most of them have a deleterious effect on pigments and thus cannot be safely employed for eradicating insects from paintings, unless they are used under carefully controlled conditions. The usual fumigants, which are employed for eradication of insects from perishable organic antiquities such as manuscripts, furs, etc., may have a damaging effect on pigments. Carbon disulphide, carbon tetrachloride, methyl bromide and carb-oxide are used as fumigants for destroying insects, but their prolonged action is avoided. The fumigation of paintings inside large monuments is beset with considerable practical difficulties, since due to absence of closed space, the fumigants cannot act on the paintings for appreciable periods without marked dilution. Even in museums the treatment of old paintings with fumigants requires great care, and the effective eradication of insect pests from painted surface in large monuments is much more difficult. The use of paradichlorobenzene and D.D.T. is to be avoided save in exceptional cases where there may be special circumstances calling for their use.

4. PROTECTION OF PAINTINGS AGAINST FUNGUS

Damage due to fungus is a very common feature of Indian wall paintings. The fungal growth is encouraged by high humidity, and unless the monuments are absolutely water-tight, seepage of rain-water into the interior not only results in damage to plaster, but it also encourages fungal growth on painted surfaces. Formaldehyde and thymol have been found to be effective in eradicating the fungus.

5. CHEMICAL PRESERVATION OF TYPICAL PAINTINGS IN INDIA

The problems of chemical treatment and preservation of paintings have been discussed in general. What has been said in respect of murals applies *mutatis mutandis* to oil paintings on canvas or panel, miniature paper paintings and paintings on silk. Since, however, no two paintings present exactly the same problems of chemical conservation, each case has to be examined independently and suitable methods are to be devised for proper cleaning, preservation and maintenance. No hard and fast rules can, therefore, be laid down or set formulae prescribed for chemical treatment and preservation of paintings of different types. It would, therefore, be desirable that the methods and materials employed in the chemical preservation of paintings are described in general. Indian mural paintings present complicated problems of conservation due to rigorous climatic conditions varying markedly from region to region. A brief discussion of the chemical conservation of typical paintings from different parts of the sub-continent would, therefore, give a bird's eye-view of the techniques adopted for their preservation. Such a discussion would also highlight the problems which are generally encountered in the scientific conservation of murals under varying climatic conditions.

The effect of various solvents on old varnish, such as is seen on the paintings at Ajanta, Ellora, Fatehpur Sikri and other sites, has been carefully studied and effective solvents have been found for dealing with this problem without in any way disturbing the pigments.

As the following account would show, suitable chemical methods have been adopted for dealing with surface accretions and a fair measure of success has been achieved in eliminating old darkened varnishes. It is, however, necessary to pursue long-term researches for evolving methods of air-purification and dust-control and for determining the properties of materials proposed to be used as surface fixatives for loose pigments, or for

consolidation of weak priming or plaster. More effective and better methods have also to be evolved for dealing with algae and insects. Below is presented a rapid review of the work of chemical conservation which has been carried out on the mural paintings at many sites. Elaborate chemical treatment has been carried out on the wall paintings in Maryam Zamānī's house and other monuments at Fatehpur Sikri, Sunhari Maḥal at Sikandara, tomb of I'timādu'd-Daula at Agra, Tambekarwada at Vadodara, Mahākālī temple at Chandrapur, Aṣār Maḥal at Bijapur and the rock-cut caves at Bagh, Badami and Ajanta.

A. Maryam Zamānī's house, Fatehpur Sikri

A heavy layer of darkened and dust-laden varnish has been successfully removed from the painted surfaces specially by the application of methyl alcohol and also rectified spirit. The reagents were more effective in their solvent action when allowed to act on the varnish layer for about ten minutes when the varnish became soft and easier of removal. At certain places where the red and other pigments were observed to begin to soften and run as a result of the action of these solvents, acetone was used after the initial stages of cleaning. Petroleum spirit and petroleum ether were utilized as restrainers to prevent the running of colours. Those painted areas, over which the varnish did not yield to the solvent action of methyl alcohol, acetone and rectified spirit, were cleaned with these chemicals after addition of some butyl alcohol; with the latter, however, the red pigment did not appear to be stable, if it remained under the effect of the solvent for more than a few minutes. Where the varnish did not respond to these solvents, ammonia in rectified spirit was tried with success. In the library at Fatehpur Sikri, the varnish layer, though dark, was comparatively thin and soluble in acetone.

B. Other monuments at Fatehpur Sikri

Apart from the paintings in Maryam Zamānī's House, extensive mural paintings are also extant in some other monuments at Fatehpur Sikri. Most of them have been executed in tempera technique and different pigments, including gold, were used with a resinous binding medium. Generally, the paintings have been done on thin lime plaster, but some have also been executed on the red sandstone surface, specially polished to receive the brush-work.

On examination, these paintings were found to have undergone much deterioration. A few of them appeared to have been coated at some period of their history with thick layers of varnish. The varnish had become dark, brittle and opaque and the original colours had been largely obliterated. Large-scale flaking of the pigments had also resulted in their deterioration. The painted plaster had become loose at places and required consolidation.

In view of their unsatisfactory state of preservation, the paintings were subjected to elaborate chemical conservation. Several organic solvents were used; out of these, acetone, methyl alcohol, ethyl alcohol, ether, cellosolve and cellosolve acetate were found effective in eliminating the various accretions without adversely affecting the pigments in any manner. The treated surface was given a protective coating of a 3–5% solution of polyvinyl acetate.

C. Sunhari Maḥal, Sikandara and tomb of I'timādu'd-daula, Agra

The wall paintings in Sunhari Maḥal at Sikandara, and in the tomb of I'timādu'd-Daula at Agra have been done on a highly finished lime plaster having a marble-like

texture. The technique of these paintings is tempera; gum, glue or resin have been used as the binding medium. It is probable, though not proved, that some of these paintings may have been done in fresco technique (*fresco buono*) which apparently began to be practised in India from about the sixteenth century.

These murals had suffered considerable deterioration on account of flaking and discolouration and loss of pigments due to the darkening effect of dirt and smoke. At places, the painted surface was found to have been coated with thick layers of varnish which, in the course of centuries, had become brittle and dark. The paintings showed, particularly at lower levels, a general darkening and browning effect, partly attributable to dirt and finely-divided soot from the incense burnt inside the tombs and partly to frequent touching by visitors. The paintings also exhibited an appreciable disturbance of the painted surface in as much as the pigment layer appeared slightly rough and worn-out at places. This feature was more marked in the paintings in the tomb of I'timādu'd-Daula than in those at Sikandara and was attributable to the sand-blasting effect of dust-laden winds. Salt-efflorescence and mould growth were noticeable in patches on the painted surface. The pigment layer showed a tendency to curl up in fragments resulting in eventual flaking and loss of colours. These curled-up fragments of the pigment layer exhibited unusual brittleness caused by changes in relative humidity and temperature.

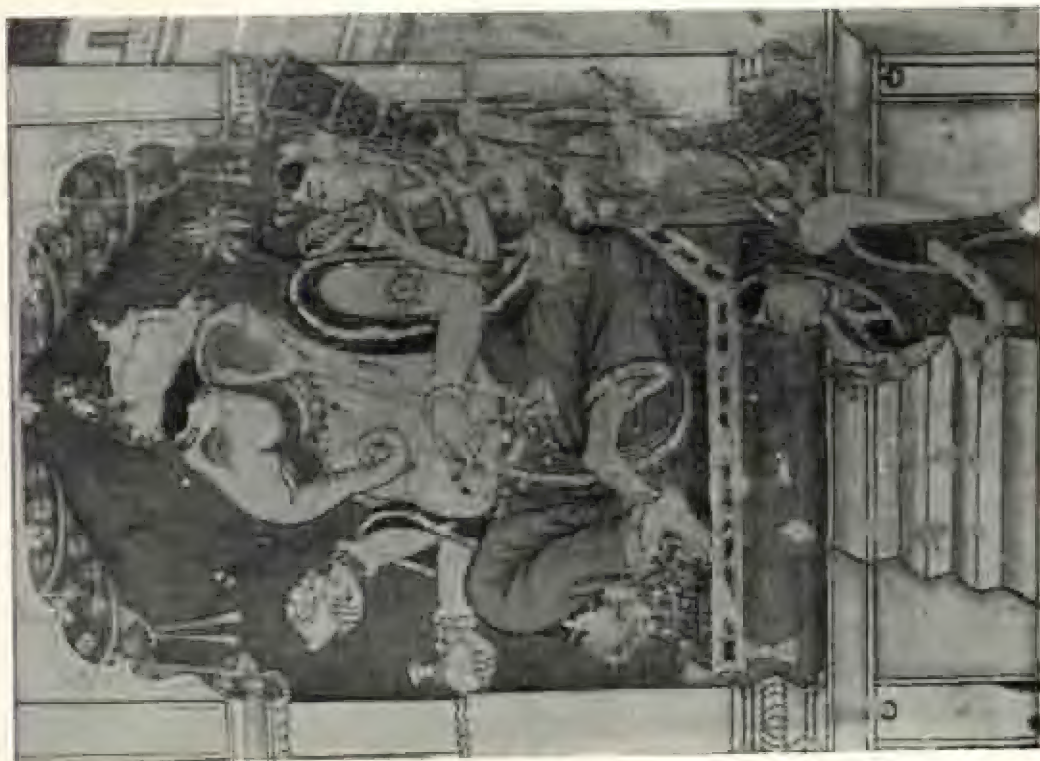
A close examination of the pigments revealed a marked yellowing, fading and alteration of colours. It is probable that these changes were induced by sunlight and hot winds. Whether chemical changes such as oxidation, etc., were also responsible for the changes in colours cannot be ruled out.

Large-scale chemical treatment has been carried out at these sites. Dust and dirt were removed mechanically with soft brushes and cotton wool. Greasy accretions yielded to the action of a mixture (1 : 5) of ethyl alcohol and solvent naphtha. Smoke and soot were successfully eliminated from the painted surface with a mixture of triethanolamine and ethyl alcohol. The white plastered areas with painted ornamental borders were treated with ammonia water (1 : 40) and aqueous triethanolamine (1 : 50). Resistant accretions were kept in contact with suitable organic solvents for long periods in order to solubilize them; when softened, they were removed with swabs of cotton wool. Ethylene glycol was also used on certain painted areas for softening hard crusty accretions; when softened, they were removed with swabs of cotton wool soaked in alcohol, using naphtha as a restrainer. Some dark resistant patches yielded to the action of very dilute hydrogen peroxide applied with cotton wool wrapped up on wooden picks. Use was also made of butyl acetate and butyl lactate in eliminating hard, darkened accretions from some painted surfaces.

The old darkened varnish was generally removed with ethyl alcohol and turpentine. Thick layers of hardened varnish were found to yield more readily to the action of methyl alcohol. Where the darkened hard varnish was more resistant, acetone was used as the solvent with turpentine as the restrainer. The solvent was taken up in swabs of cotton wool of convenient size and they were kept in contact with small areas at a time; the dissolved varnish was taken up by fresh swabs of cotton wool. Cotton swabs impregnated with turpentine were always kept ready at hand to control, retard or stop the solvent action of the reagents. In fact, occasionally a mixture of ethyl alcohol and turpentine (1 : 10) was found satisfactory.

The painted surface, freed from the varnish and other accretions, was impregnated with a thin (3–5%) solution of polyvinyl acetate in toluene containing 2% dibutyl phthalate as a plasticizer. Use was also made of 1% solution of polymethyl methacrylate in toluene





A B

Vadodara. Tambekarwada: wall-painting, A, *before, and* B, *after treatment.* *See p. 89*





A B

Vadodara, Tambekarwada: wall-painting, A, *before, and* B, *after treatment.* *See p. 89*



Chandrapur, Mahakali temple: wall-painting, the right-half showing the result of chemical treatment. *See p. 89*





A B

Bagh, Cave No. 2: wall-painting, A, *during, and* B, *after treatment.* *See p. 90*

To face pl. XXXIX



A



B

Ajanta, Cave No. 16: mural painting, A, before, and B, after treatment. *See p. 92*





A B

Ajanta, mural painting, A, *before, and* B, *after treatment.* *See p. 92*





A B

Talbahat, Narsinghji temple: wall-painting, A, *before, and* B, *after treatment.* *See p. 93*

To face pl. XI.



A



B

Talbahat, Narsinghji temple: wall-painting, A before, and B, after treatment. *See p. 93*

containing 2% dibutyl phthalate as a plasticizer for surface impregnation of some of the paintings. It was, however, found that although the darkening and glossy effect produced by solutions of polyvinyl acetate was absent and the surface presented a dull matt surface, in course of time, the surface treated with polymethyl methacrylate developed a whitish and hazy film which detracted from the beauty of the paintings. The use of polymethyl methacrylate as a surface preservative was, therefore, discontinued.

D. Tambekarwada, Vadodara

For elimination of the varnish layer from the painted surface, ethyl alcohol and acetone were found to be satisfactory. Butyl alcohol and sulphuric ether were also put to some use. A touch of ammonia in ethyl alcohol was found effective in the regeneration of the blue colour which had become very dull. Turpentine was brought into use to prevent the running of colours. On painted surfaces, where the solvent action of the above-named chemicals was not satisfactory for the removal of varnish, methyl alcohol was found to be effective. The treatment has resulted in the regeneration of all old colours in their original brightness (pls XXXV, XXXVI and XLV).

E. Mahākalī temple, Chandrapur

The paintings were found covered with varnish, oily accretions and smoke from incense burners and were disfigured by splashes of lime-wash. Generally, the reagents used for chemical treatment of paintings at Fatehpur Sikri and Tambekarwada, Vadodara, were ineffective in the case of accretions over the paintings here, although methyl alcohol appeared to have a perceptible solvent action on the oily layer. Rectified spirit or methyl alcohol containing 5–10% butyl lactate has been used with success for removal of the varnish. This reagent took about ten minutes to soften the varnish, which could then be slowly removed with swabs of cotton wool. The splashes of lime mostly lay on the varnish layer and automatically came off with it, while the more resistant streaks were carefully scraped away mechanically. It was observed that the varnish on the paintings was capable of removal only with the help of butyl lactate-alcohol mixture and use of this reagent for periods longer than ten to fifteen minutes at a time was not without its deleterious effect on the red pigment of the figures and the background which is exclusively in this colour. The work of chemical treatment and preservation of these paintings, therefore, involved great caution and judgement in the use of solvents, but the results were found to be thoroughly satisfactory (pl. XXXVII).

F. Āsār-Mahal, Bijapur

Here the paintings, upto a height of about two metres from floor-level, were overlaid with a very thick yellow varnish layer which had also absorbed considerable amounts of dust. The varnish coating was present even on areas from where the paint layer had flaked away. Although many solvents like toluene, benzene, ethyl alcohol, etc., were found capable of softening and removing the varnish to a greater or lesser degree, a tendency of the colours to run was clearly visible if the solvent action of these chemicals extended over a few minutes. Furthermore, the colours were rather drab in appearance and the outlines of many of the figures tended to mingle with the colour of the background. The use of these solvents had also its effect on the colours, and even a momentary or unconscious relaxation of attention, when these solvents were acting upon the varnish layer, was found to lead to the softening of pigments. Further investigations showed that

ethylene glycol monoethyl ether was very efficacious in the removal of the varnish layer and its use was found to be completely free from any deleterious consequences to the pigments. The paintings were, therefore, cleaned with ethylene glycol monoethyl ether.

G. Bagh caves

In Cave No. 2, the paintings were practically invisible through a thick layer of smoke and tarry and fatty accretions. Chemical treatment of the paintings (pl. XXXVIII) involved applications of 10% solution of ammonia in rectified spirit. This softened the smoke to some extent and made possible its partial removal with the help of absorbent cotton soaked in spirit. A mixture of 1 : 10 triethanolamine and butyl lactate was then applied to the painted surface. With the help of this cleansing mixture, the effect of which was greatly accelerated by the addition of 10–20% water, the smoke was dissolved away into a thick black emulsion which had to be eliminated from the painted surface with copious amounts of rectified spirit. The treatment of these paintings has been an extremely laborious and time-consuming process; it has, however, brought to light many panels. After this successful treatment, some of the treated paintings have suffered considerable deterioration, due to the ingress of rain water. Suitable measures of structural conservation have to be taken for the stoppage of percolation of water into the painted caves.

H. Badami caves

The paintings, surviving in patches only, were found covered with dust, dirt and incrustations of various kinds. They had been preserved in the past with shellac and vinyl acetate, and thick coats of hard varnish had thus formed on the paintings. The famous panel, depicting the betrothal of Śiva and Pārvatī, also survived in patches only and most of the pigments, pink, red, green, yellow, blue, black, brown and white were lost. The old preservative was easily removed with a mixture (2 : 1) of toluene and methylated spirit. The removal of dust, dirt, etc., was successfully carried out with a mixture (2 : 1 : 2) of butyl lactate, toluene and butyl alcohol. For red and green colours, which were hidden under layers of incrustations, benzene and acetone were found effective. The surviving remains of these highly fragmentary paintings have, however, been preserved and the pigments protected from further deterioration.

J. Ajanta caves

The paintings, which are on mud plaster, finished with a thin layer of limewash, on the walls and ceilings in this group of caves, were found covered with accretions like soot, oil, cobwebs, insect nests and insect cocoons. These accretions had accumulated through long neglect. With the passage of time, the oily accretion became hard and it cemented other accretions to the painted surface. In addition, the use of solutions of unbleached shellac[1] by Italian restaurateurs Cecconi and Orsini in 1920 and 1921 as a fixative for the flaking pigments, and its later use by the then Hyderabad Government had resulted in the formation of a thick layer of dark brown colour on the painted surface.

The plaster on the rock surface had become loose in the course of centuries and had lost its hold at many places partly on account of deterioration of the binding material and

[1]B. B. Lal, 'The murals: their composition and technique', and 'The murals: their preservation' in A. Ghosh (Ed.), *Ajanta Murals* (New Delhi, 1967), pp. 53–55 and 56–59.

partly due to expansion and contraction caused by variations in humidity and temperature. The pigment layer had become dry and had developed a tendency to peel off. This deterioration had been progressing steadily through the centuries and is an inherent characteristic of the paintings which have remained exposed to ravages of elements.

A detailed study of the causes of decay of these murals has already been published.[1] This has been followed by an exhaustive examination of the various factors which go to constitute these paintings and of the causes of their deterioration. The results of these investigations are under publication elsewhere. It may be stated here that although the slow deterioration of these paintings is undeniable, there is no evidence of any rapid decay. The slow progressive decay is the natural effect of age, and chemical treatment has been and is being steadily carried out with all the care and caution to combat this natural tendency to deterioration.

Among the important factors responsible for the damage, special mention may be made of the marked changes in temperature and relative humidity. These changes have resulted in the loosening of the painted plaster, flaking of the priming and the pigments, growth of fungus and the breeding of insects. Atmospheric pollution is another cause of decay. Dust settles on the painted surfaces. In course of time it becomes hard and firm and produces a translucent to opaque film on the paintings. Smoke given out by fires and lamps lit inside the caves has disfigured the paintings by depositing thereon thick layers of sooty, tarry and oily matter.

Due to prolonged desiccation and the action of atmospheric oxygen, carbon dioxide and moisture and the depredations by insect pests, the binding medium originally present in the pigments has lost its adhesive property. As a result, the pigments have developed a tendency to flake off.

Many of these paintings were preserved, at the time of their discovery and later, by using liberal quantities of shellac and other varnishes. The natural resins are not permanent, but become dark and brittle with age. The old varnish has not only darkened and obscured the details of the paintings, but the depths and tones of original colours have considerably altered.

These paintings have been freed from dust and sooty and greasy accretions. It has also been possible to remove the old darkened and brittle shellac varnish from the painted surfaces. Suitable solvents and reagents and techniques based on the conservation work discussed above, have helped in eliminating all surface accretions, in consolidating the weakened and friable painted surface and in restoring the original colours.

For evolving suitable materials and techniques for dealing with the complicated work of preservation of the paintings without any injurious effect on the pigments or the plaster, various organic solvents and their mixtures in different proportions were experimented with. Since low-boiling solvents produced a chalkiness on the paintings, different mixtures of organic solvents such as methyl alcohol, ethyl alcohol, butyl alcohol, diacetone alcohol, 2-ethoxy ethanol, acetone, sulphuric ether, morpholine, triethanolamine and dibutyl phthalate were tried on insignificant parts of the paintings and their effects carefully observed. By a judicious combination of the physico-chemical properties of organic solvents, it has been possible to evolve effective cleansing solutions for the elimination of the various accretions from the painted surface without adversely affecting the pigments and the plaster.

[1] *Ibid.*, pp. 33–39; also see, B. B. Lal, *Ajanta paintings: their composition, technique, deterioration and preservation* (in press).

The well-known technique of filleting was successfully employed for securing the broken edges of painted plaster to the 'carrier'. For fixation of loose pigments and for the consolidation of the painted surface, use was made of 3–5% polyvinyl acetate dissolved in toluene-ethylene dicholoride-ethyl alcohol mixtures in suitable proportions; dibutyl phthylate was used as a plasticizer. Painted surfaces treated with 1% polymethyl methacrylate on a limited area developed a slight translucency with the passage of time. The use of polymethyl methacrylate was discontinued in spite of its useful property of leaving the painted surface free from gloss and the pigments in their original tones. The film of polymethyl methacrylate attracted a lot of dust and the resin became partly insoluble in the usual solvents. Preservation of these paintings was, therefore, carried out with thin solutions of polyvinyl acetate. In this manner many paintings in the caves have been chemically treated and preserved (pls. XXXIX and XL).

Apart from the above, extensive work of preservation has been done on the mural-paintings at water pavilion, Kumutgi, District Bijapur, Darbargarh, Sehore, District Bhavnagar, Khusraubāgh, Allahabad, Narsinghji temple at Talbahat, District Jhansi and Ravanachhaya at Sitabenji in District Keonjhar. The mural paintings inside the Brihadiśvara temple at Thanjavur have also been subjected to elaborate chemical treatment and conservation. The chemical conservation of these paintings may now be considered.

K. Water-pavilion, Kumutgi and Darbargarh, Sehore

The chemical treatment and preservation of paintings at Kumutgi and Sehore, which have been executed on lime plaster, involved the elimination of accumulated dust, dirt, bats' excreta, greasy and oily accretions and the old darkened varnish and the removal of lime and water stains. It was followed by general chemical cleaning of the paintings for removing the chalkiness and brightening the surfaces. The flaking pigments were fixed to the ground, loose plaster was secured to the 'carrier' and the pigments were brightened by applying to the cleaned surface a thin (3–5%) solution of polyvinyl acetate. Solvents like alcohol, acetone and toluene were found effective in eliminating the accretions and turpentine was used as a restrainer for controlling their action. Soot and grease yielded to the action of a mixture (1 : 10) of triethanolamine and ethyl alcohol.

L. Khusraubāgh tombs, Allahabad

The paintings at Khusraubāgh, Allahabad, done on thick lime plaster with colours mixed with a resin have suffered considerably due to weather action. The pigments, red, green, white, yellow, black and their mixtures, showed extensive flaking, exposing the lime priming underneath. The paint layer is appreciably thick (0·5 mm.–1·00 mm.) and shows a network of cracks. At many places, the paint-film had curled up and was in imminent danger of falling off.

Dust, dirt and other surface accretions were removed mechanically by using soft brushes and absorbent cotton. The old darkened films of varnish and greasy accretions were eliminated by applying organic solvents to limited portions of the painted surface; the dissolved grease and varnish had to be absorbed and taken up by cotton wool, swabs of which were frequently changed. Many organic solvents were found useful for the elimination of the old darkened varnish, but generally alcohol and acetone were used, suitably diluted with turpentine, which acted as a restrainer and slowed down their action.

In order to determine the proportion of various solvents and the restrainer, preliminary cleansing tests were carried out on inconspicuous parts and edges of the painted surface. A mixture of ethyl alcohol and turpentine (1 : 5) was found quite satisfactory. The reagents were effective in softening and dissolving the greasy deposits and the hardened varnish layer without in any manner harming the pigments or the binding medium or the plaster. The flaking pigments were secured to the ground with thin solutions of polymerised vinyl acetate, which was also found suitable as a fixative for loose plaster.

M. Narsinghji temple, Talbahat

The paintings in Narsinghji temple at Talbahat, District Jhansi, presented complicated problems. Done on lime-sand plaster, which is quite thick at places (1–2 cm.), with colours mixed with a gummy resinous material, the paintings show a fairly thick paint layer (1 mm.–1·5 mm.) traversed by a network of cracks. Grease, smoke, and tarry accretions had largely obliterated the paintings, which also showed thick layers of limewash and were thus largely hidden from view.

Dust and dirt were mechanically removed, using soft brushes and cotton wool. The removal of lime was a difficult problem, as the use of any acid was out of question. It was generally removed mechanically, using small wooden mallets covered with rubber and scrapers, suitably mounted on wooden handles, and an assortment of steel needles and wooden picks. The use of distilled water on a restricted scale had to be resorted towards the end, when faint daubs of limewash were very carefully eliminated by using cotton wool charged with distilled water.

For removal of greasy, tarry and smoky accretions, use was made of alcohol, acetone, ether and triethanolamine. Where simple solvents were used, a hazy deposit made its appearance on the treated surface. This 'bloom' or blanching effect was due to the chalkiness resulting from single solvent treatment; it was not due to any interaction between the solvents and pigments, binding medium or the plaster. The chalkiness was attributable to the relatively high rate of evaporation of the solvents. Suitable mixtures of these solvents were, therefore, employed and the cleaning of the painted surface could be carried out without producing any 'bloom'. The treatment yielded spectacular results and the obliterated paintings were brought to light in their original brightness.

The loose pigments were secured to the ground with thin solutions of polyvinyl acetate. The weak friable plaster was consolidated with a thin solution of polyvinyl acetate and the broken edges of painted plaster were secured to the 'carrier' by filleting with plaster of Paris, suitably tinted with matching colours (pls. XLI and XLII).

N. Ravanachhaya, Sitabenji, Keonjhar

The under-surface of a gigantic granite boulder resting on another huge boulder protruding from the ground at Sitabenji, about 107 km. from Jajpur Road in District Keonjhar, Orissa, carries some faded remains of mural paintings. This umbrella-shaped boulder is called "Ravanachhaya", and its under-surface is very rough and undulating. The paintings were executed directly on the rough rock-surface without smoothening it by plastering and priming. Only a thin coat of limewash seems to have been applied to the rock-surface before it was painted in earth colours. It is likely that some binding medium such as gum or glue was used with the pigments to secure a proper bond between the rock-

surface and the colours. Red, white and yellow are the surviving colours; mixtures of these were also used to produce shades of red, yellow and buff.[1]

The first step towards conservation of these paintings was to cut a throating in the rock-surface around the painted area with a view to preventing rain water from spreading on the painted surface.

The factors responsible for the deterioration of these paintings were, extensive flaking of the pigments, possibly due to the decay of the binding medium, growth of insect nests and accretions of dust, dirt and cobwebs, apart from adverse weather action on account of prolonged exposure to sun and rain.

Ethyl alcohol was used with satisfactory results in general cleaning of the painted surface, which was consolidated and preserved with 1% solution of polymerised methyl methacrylate containing 2% dibutyl phthalate as a plasticizer. The general cleaning of the painted surface and its consolidation with methyl methacrylate resulted in an appreciable brightening of the pigments and their firm adhesion to the rock-surface. However, with the passage of time, the painted surface was observed to have become slightly hazy with the development of a general chalkiness. Consequently, it was decided to eliminate the coating of polymethyl methacrylate and to preserve the painted surface with polyvinyl acetate instead. Much difficulty was experienced in eliminating the old acrylic resin which was found to have become somewhat insoluble in the usual solvents. By using acetone, toluene and ethylene glycol, however, the old resin was gradually softened and although it could not be completely solubilized, it was rendered soluble enough to be taken off the painted surface with swabs of cotton wool, impregnated with the solvent mixture, without disturbing the layer of paint. After elimination of as much of the methyl methacrylate resin as possible, the painted surface was impregnated with a thin solution (3–5%) of polyvinyl acetate. This application brought out all the details and the entire painted surface became clear and bright, although it became slightly glossy.

P. Bṛihadīśvara temple, Thanjavur

The narrow corridor around the main shrine inside the Bṛihadīśvara temple, Thanjavur, carries extensive paintings on the walls and ceilings. At places the painted area shows two layers of paintings. The underlying paintings are datable to the Chola period (tenth-eleventh century) and were executed on a hard, white lime plaster. The overlying paintings of the Nāyaka period of the seventeenth-eighteenth century were done on a buff lime plaster laid on the Chola paintings.

The main problems posed by these paintings were preservation of the Nāyaka paintings *in situ*, where these were not overlying the paintings of the Chola period; chemical treatment and preservation of the Chola paintings (pl. XLIII,) wherever the upper Nāyaka layer had fallen off due to natural and other causes; cleaning the Chola paintings of stray patches of overlying Nāyaka layer, and stripping of the Nāyaka paintings intact from over the Chola paintings for mounting and preserving the former and for exposing the earlier paintings for their preservation *in situ*.

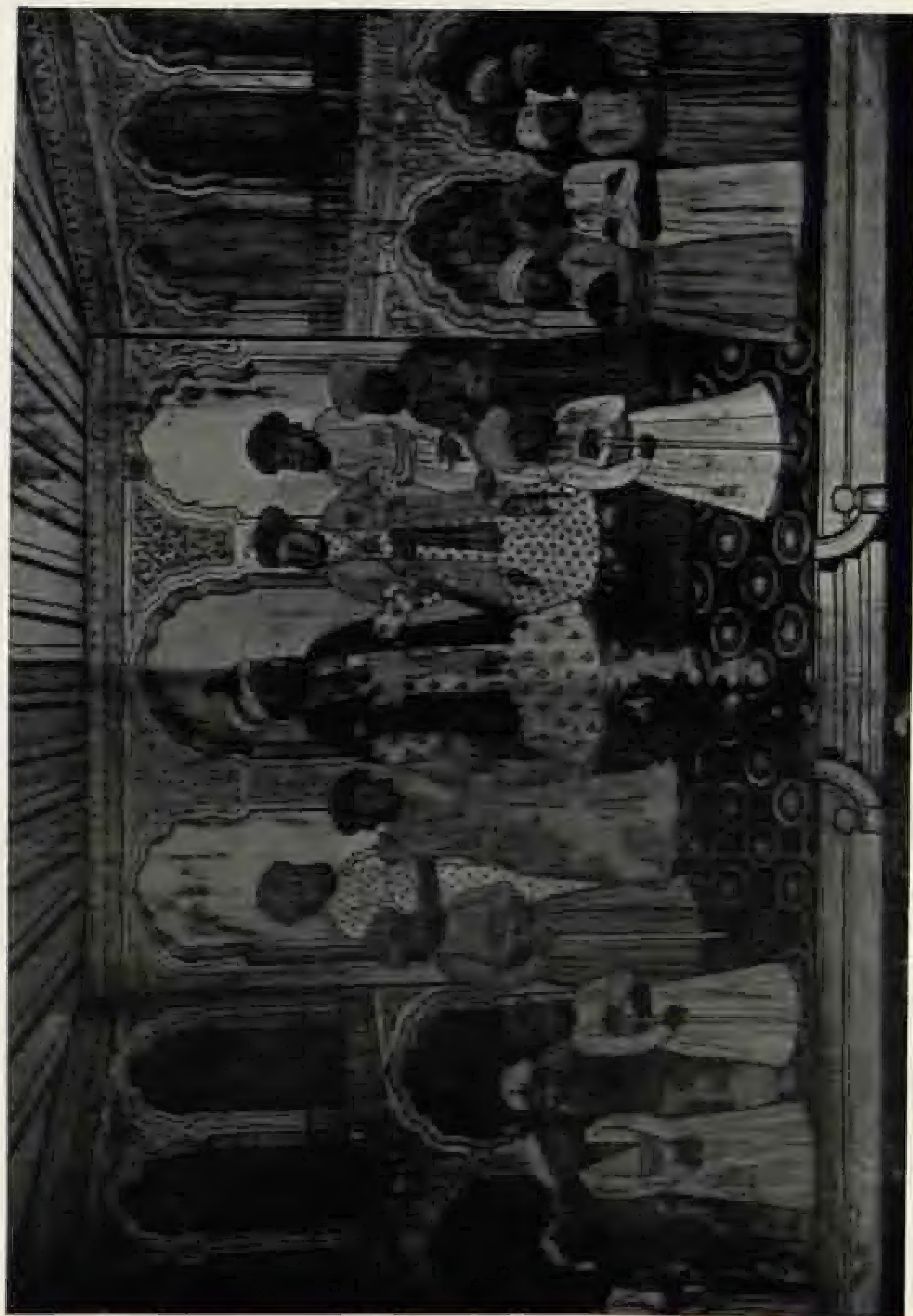
A careful scientific examination of the two paintings was carried out with a view to determining their techniques as a preliminary to devising a suitable method of stripping the upper layer without damaging the underlying Chola paintings. The plaster and the

[1]B. B. Lal, remarks in T. N. Ramachandran, 'Find of tempera painting in Sitabenji, District Keonjhar, Orissa', *Artibus Asiae*, vol. XIV, nos. 1/2 (1951), pp. 14–15.



Bṛihadīśvara temple, Thanjavur, mural painting during preservation. *See p. 94*

To face p. 94



Srirangapatna, Darya Daulat Bagh: wall-painting, the right-half showing the result of chemical treatment. *See p. 96*

pigments were examined in each case and attempts were also made to identify the binding medium, if any, present in the pigments.

A detailed discussion of the results of these investigations would be beyond the scope of the present paper. Since, however, the results are of great archaeological significance, it would not be out of place to review very briefly the results of these researches.

Suitably-selected samples of painted stucco from the two paintings were studied. Care was taken to ensure that these samples were free from any preservative that might have been used in the past for the preservation of the paintings; only specimens free from all extraneous matter were examined.

On treatment with cold water, the painted stucco from the upper layer of paintings showed a softening of pigment layer. Only a few minutes' soaking in water was enough to soften the pigments.

The pigment layer appeared to be distinctly superimposed on the finished surface of the plaster. There was no sign of diffusion of the pigments into the body of the plaster. The paint film could be easily detached from the plaster as a coherent flake, showing a weakness of the bond between the two. Examination of the plaster, which comprised three distinct layers—coarse plaster, fine plaster and pigment layer—also showed that the bond between the coarse and fine plaster was weak.

When the painted stucco comprising rough plaster, fine plaster and the pigment layer, was treated with very dilute hydrochloric acid (0·5%) in the cold, the lime dissolved away slowly and small flakes of pigment layer were found floating on the surface. The flakes varied in size, ranging from 1 mm. to 2 mm.; some of the flakes were even larger in size. The pigment layer was thus found to remain intact for an appreciable period after the dissolution of the lime. When the acid solution containing the specimens was stirred, the pigment layer was seen to move as a fluffy gelatinous mass; the particles of the pigments were evidently held together even after the dissolution of lime. Vigorous shaking resulted in the disintegration of the flakes into tiny bits which floated on the surface of the solution for a few minutes and eventually settled down after crumbling to very small particles of pigments. (The aqueous extract of the pigment layer gave a positive test with thymol; the reaction was weak but distinct.)

The painted stucco was fused with metallic sodium and the fused mass extracted with water. The aqueous extract was found to contain sulphur, nitrogen and phosphorus, but the halogens were absent. The presence of sulphur was attributable to gypsum present in small quantities in the lime plaster.

In view of these results, it is clear that the tempera technique was employed in executing the Nāyaka paintings and probably gum was used as the binding medium. Similar results were obtained with the specimens of painted stucco from the Chola paintings, but the test for the presence of gum was inconclusive. There is, however, reason to believe that the Chola paintings were also done in tempera technique.

Contrary to the findings of Paramasivan[1] there is no evidence to suggest that these paintings were done in *fresco secco* or *fresco buono* technique.

Two important considerations had to be kept in mind while evolving a suitable technique of stripping off the upper Nāyaka layer; these were the rather weak bond

[1]S. Paramasivan, 'The Mural Paintings in the Brihadiswara Temple at Tanjore—An Investigation into the Method', *Technical Studies*, vol. V, no. 4 (April, 1937), pp. 234–36; also, 'Technique of the Mural Paintings in the Brihadiswara Temple at Tanjore', *Current Science*, vol. VI, no. 6 (December, 1937), pp. 289–90.

between the two layers of plaster and the solubility of the pigments in water. Accordingly, the Nāyaka painting was treated with a thick solution of polyvinyl acetate in toluene and strips of muslin of suitable size were pasted on this surface. When the adhesive had firmly set and hardened, the projecting lower end of the cloth, was drawn at an angle of 45° to the vertical. The muslin-covered surface was very gently tapped with a wooden mallet covered with rubber, and a notch was gradually carved with a blunt knife in the middle of the plaster layer taking care to clearly keep off the painted Chola layer. By careful manipulation, it was possible to remove sizable portions of the painted stucco of the Nāyaka paintings from the Chola surface without damaging either painting. The smoothness of the Chola surface was the main reason for the successful stripping of the Nāyaka paintings. The bond between the two layers of plaster being weak, large portions of the upper layer of paintings could be removed intact and the underlying Chola paintings exposed. In this manner, a considerable portion of the superimposed Nāyaka paintings was removed from the wall.

The bulk of the plaster sticking to the stripped portions of muslin-covered Nāyaka paintings was removed by careful scrapping. They were then temporarily mounted on muslin, using a thick solution of polyvinyl actetate. The muslin-lined surface was wetted with toluene and ethyl alcohol. When the resin became soft, the muslin was gently taken off the painted surface. The Nāyaka paintings, temporarily mounted on muslin, were in forty pieces. Their final mounting, preservation and consolidation would form the subject of a separate paper.

The technique adopted above was successful in exposing the Nāyaka layer, but the method requires to be improved for large-scale application to paintings which have not been executed on hard lime-plaster, such as was used at Thanjavur. The inherent strength of the lime plaster of the Nāyaka paintings was, no doubt, a major factor in their successful removal from the lower Chola layer, and it is probable that a weaker plaster of mud and clay, such as was used for the paintings at Bagh and Ajanta, would have required a different technique of stripping.

For the elimination of dust, grease and tarry accretions from these paintings, non-aqueous solvents, such as ethereal ammonia, toluene, ethyl alcohol and ethylene glycol monoethyl ether were found useful. Impregnated with a dilute solution (3–5%) of polyvinyl acetate in toluene and ethyl alcohol using 1–2% dibutyl phthalate as a plasticizer, the paintings presented a very satisfactory appearance. The broken edges of the painted plaster were secured to the 'carrier' by careful filleting with suitably tinted plaster of Paris.

Q. Other sites

The various methods and materials discussed above were adopted with suitable modifications, where necessary, for the chemical treatment and preservation of mural paintings in the Vīrabhadrasvāmī temple at Lepakshi in District Anantapur, the paintings in the Kailāsanātha temple at Kanchipuram, District Chingleput, the paintings in the Channakeśavaperumal temple at Somapalle, District Chittoor. Extensive wall paintings inside Darya-Daulat Bagh at Srirangapatna, District Mandya (pl. XLIV) have been subjected to chemical treatment with very satisfactory results. Paintings in the rock-cut cave-temples at Sittannavasal near Pudukkottai, District Tiruchchirappalli and at Tirumalaipuram, District Tirunelveli, were also successfully treated and preserved in the above manner.



A



B



C



D

Vadodara, Tambekarwada: wall-paintings, A *and* C*, before, and* B*, and* D*, after treatment.* *See p. 89*

6. NEED FOR STRUCTURAL CONSERVATION

Since one single factor, which has contributed to extensive decay of our murals, is moisture, efforts have been made to render the painted walls and ceilings dry by carrying out suitable structural repairs. This simple but very important measure has saved many mural paintings from further deterioration. While carrying out structural repairs, due care was taken in the choice of building materials, and only those materials were used as were found free from injurious soluble salts

The filling of large cavities and gaps between the plaster and the 'carrier' is carried out by injecting a thick solution of polyvinyl acetate in toluene mixed with coarse sand. The mixture is allowed to fill up the cavities and gaps, care being taken to plug up all cracks and crevices which may otherwise allow this cement to flow out. The plaster is kept gently pressed against the 'carrier' so long as this cement does not set.

7. CHOICE OF PRESERVATIVES AND ADHESIVES

The problem of finding out suitable preservatives for the murals has been engaging the attention of conservators but no satisfactory solution has been found as yet. This is mainly due to the fact that the properties demanded of such preservatives are many and varied. An ideal preservative for wall paintings should be easy to apply under controlled conditions. It should be colourless and transparent and should not turn yellow or become discoloured with age, but should be fairly stable for long periods of time. It should also offer reasonable protection to the paintings against moisture, and its film should be hard and strong enough to protect the painted surface from injurious accretions. Needless to say, such an ideal preservative is yet to be evolved.

Dammar and mastic are two natural resins which have been employed for varnishing oil paintings. The natural shellac has been made use of for preserving mural paintings in India. Synthetic resins such as polyvinyl acetate and polymethyl methacrylate have been used in recent years for the preservation of paintings on plaster, canvas, and paper. Hard paraffin wax and bee's wax have occasionally come in handy for fixing loose pigments and for consolidating painted surfaces. Although these preservatives have been successfully used for fixing loose pigments and for consolidating friable painted surfaces, their after-effects have, in many cases, been found to be undesirable, and need has all along been felt for the development of preservatives which are suitable in all respects.

The natural resins produce brittle films; paintings varnished with mastic and dammar, therefore, show a network of cracks on the surface. These resins are not only liable to yellowing, blooming and wrinkling, but they also become dark with age and lose their binding capacity on account of oxidation. Their use as a preservative for mural paintings is, therefore, open to serious objection. Wax suffers from the same drawbacks. In hot and humid conditions, it has a tendency to produce chalkiness on the painted surface, apart from attracting dust and grime. It excels all other preservatives in its water-proofing properties, but the paintings treated with wax become dark and loose their original tonal values.

Polyvinyl acetate and polymethyl methacrylate form tough flexible films from solutions in organic solvents. Since the refractive index of polymethyl methcrylate is distinctly lower than that of the vinyl resin, the former does not produce any appreciable change in the depth of colours. Moreover, the acrylic resin is more resistant to moisture than the vinyl resin. These considerations led to the gradually increasing use of polymethyl methacrylate in place of polymerised vinyl acetate, which has a marked tendency to alter the optical character of a painting by producing a highly glossy surface

and increasing the depth of colours. In addition, polyvinyl acetate has a tendency to swell in the presence of water. However, it has been observed that polymethyl methacrylate becomes hard and insoluble and even translucent with the passage of time, wheras films of polyvinyl acetate are not affected, but remain fully soluble and completely flexible and transparent under the same conditions. Polymethyl methacrylate in thin films has been found to undergo cross-linking, when exposed to light and heat. The cross-linked resin merely swells under the action of solvents and assumes its original volume when the solvent has evaporated. Weakly cross-linked resins can be brushed away with comparative ease in the swollen condition; strongly cross-linked resins become very hard and almost insoluble. For this reason, the use of polymethyl methacrylate solution as a surface preservative of paintings is fraught with serious risks and should be avoided. On account of appreciable cross-linking in polymethyl methacrylate, which results in insolubility and even translucency, no long-chain linear polymer of any kind is now used in the National Gallery, London.[1] Under tropical conditions, such as obtain in India, the use of polymerised methyl methacrylate for the preservation of mural paintings is all the more objectionable; its use has, therefore, been totally discontinued.

Many natural synthetic gums and resins are being experimented with in the Western countries for assessing their usefulness as preservatives, adhesives, fixatives and consolidants. Some of them, such as AW 2 and MS 2,[2] which are cyclohexanone- and methyl cyclohexanone-formaldehyde resins, and N-hydroxymethyl nylon[3] (soluble nylon) appear to be suitable for preservation of mural paintings. Epoxy resins[4] represent another class of strong adhesives which are suitable for fixing loose painted plaster to the 'carrier'. Similarly, carboxymethyl cellulose sodium salt[5] is an excellent cement for loose plaster. Bedacryl, a polymethacrylate ester, is another useful fixative for loose pigments. In a recent study, Philippot and Mora[6] have discussed the use of natural and synthetic resins in the preservation of mural paintings with reference to gumlac, isobutyl methacrylate, and soluble nylon. The properties of a wide range of new synthetic materials with regard to their suitability for the conservation of cultural relics have been studied by many workers. Werner's[7] account of the behaviour of epoxy resins, polyester resins, soluble nylon, synthetic waxes, polyvinyl acetate and polyacrylates is exhaustive and interesting.

The materials employed for the preservation of murals in other countries may now be discussed. The seventeenth century Italo-Byzantine icon representing the Nativity of Christ[8] was preserved with two coats of 7% polyvinyl acetate in ethyl alcohol followed by waxing and polishing. The sixth century Sigirya murals in Ceylon were preserved

[1]Garry Thomson, 'Some Picture Varnishes', *Studies in Conservation*, vol. III, no. 2 (October, 1957), pp. 64–79.

[2]*Materials used in the Conservation of Cultural Property*, International Centre for the Study of the Preservation and the Restoration of Cultural Property (Rome, 1963), pp. 28–29.

[3]*Ibid.*, pp. 39–40.

[4]*Ibid.*, pp. 40–41 and 43.

[5]*Ibid.*, p. 39.

[6]Paul Philippot and Paolo Mora, *Technique et conservation des peintures Murales*, International Centre for the Study of the Conservation of Cultural Property and ICOM Committee for Museum Laboratories, Reunion meeting at Washington and New York, September 17–25, 1965, pp. iii, 14–27.

[7]A. E. Werner, 'New Materials in the Conservation of Antiquities', *Museums Journal*, vol. 64 (1964), pp. 5–16.

[8]Sheldon Keck, 'The transfer of a small icon to a support of Vinyl resin', *Technical Studies*, vol. IX, no. 1 (July, 1940), pp. 11–19.

with a thin solution of polyvinyl acetate. The famous murals of Horyuji temple at Nara[1] in Japan were preserved with moderately polymerised methyl methacrylate. It was dissolved in a mixture of acetone, diacetone alcohol, benzyl alcohol, toluene and dibutyl phthalate. The warped pigment film was attached to the surface with aqueous polyvinyl alcohol. The fourteenth-century paintings of the Kariye Camii at Istanbul[2] in Turkey were thinly coated with polyvinyl acetate. Kostrov and others[3] have found polybutyl methacrylate to be an effective preservative and consolidant of mural paintings on loessic plaster.

Iwasaki[4] has reported that polyvinyl alcohol and acrylic resin were used in Japan with good results for preventing peeling off of pigments of paintings. According to Pirnat,[5] the aqueous medium Coptic paintings in Egyptian and Sudanese Nubia were fixed with polyvinyl acetate. The loosened and pulverized pigments of the Giotto frescoes in Scrovegni Chapel at Padua[6] were fixed with an emulsified acrylic resin. The scaling of the painted surface was remedied by applying to it a solution of acrylic resin, Acryloid B-72, in a quantity sufficient to ensure an effective penetration into the underlying layers. The mural paintings in the Byzantine church of Sancta Sophia at Trebizond[7] in Turkey were preserved with 1·5% polyvinyl alcohol in water.

In U.S.S.R., Kostrov and his co-workers[8] have made extensive use of polybutyl methacrylate for preservation of murals. According to Sejnina,[9] the paintings excavated in Middle Asia were consolidated with polybutyl methacrylate dissolved in xylene, and solutions of this resin in white spirit, carbon tetrachloride or xylene showed a marked permeation into the porous plaster, even when the latter was moist. Polybutyl methacrylate dissolved in acetone or methylethyl ketone was also found to be an effective adhesive. A large amount of the resin could be introduced below the painted surface by repeatedly treating it with 15·25% solution of the polymer in xylene and then retarding the rate of evaporation of the solvent.

Wolniewicz[10] carried out the preservation of the murals from the chateau at

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[1]Kazuo Yamasaki, 'Review of Conservation of Old Art Objects in Japan,' *Studies in Conservation*, vol. III, no. 2 (October, 1957), p. 85.

[2]Carroll Wales, 'The Treatment of Wall Paintings at the Kariye Camii,' *Studies in Conservation*, vol. III, no. 3 (April, 1958), p. 123.

[3]P. I. Kostrov and E. G. Sheinina, 'Restoration of Monumental Painting on Loess Plaster using Synthetic Resins', *Studies in Conservation*, vol. VI, nos. 2 and 3 (August, 1961), pp. 90–106.

[4]T. Iwasaki, 'Scientific preservation methods for cultural properties. III. Preservation of paintings', *Museum* (Tokyo), 141 (1962), pp. 23–25.

[5]M. Pirnat, 'Detachment and conservation of Coptic frescoes in Egyptian and Sudanese Nubia (Slavic)', *Varstvo Spomenikov* (Ljubljana), vol. 9 (1962–64), pp. 104–20.

[6]Leonetto Tintori, 'The State of Conservation of the Frescoes and the Principal Technical Restoration Problems', *Studies in Conservation*, vol. 8, no. 2 (May, 1963), pp. 37–41.

[7]David Winfield, 'Sancta Sophia, Trebizond—A Note on the Cleaning and Conservation Work', *Studies in Conservation*, vol. 8, no. 4 (November, 1963), p. 127.

[8]P. I. Kostrov, E. Sheinina and I. Nogid, 'Restoration of ancient monumental paintings on loess plaster and painted loess sculpture', Reunion meeting of the Committee of ICOM for museum laboratories and the Sub-Committee, for the treatment of paintings, 16–23rd September, 1963 (Leningrad, 1963).

[9]E. G. Sejnina, 'A method for restoration of frescoes found during archaeological excavations', *Zavoda Za Likovne Umjetnosti Bulletin*, vol. 13, nos. 1–3 (Zagreb, 1965), pp. 91–97.

[10]Z. Wolniewicz, 'Selection of materials and adopted means in the conservation of the original layer of mural paintings by the conservation workshop for historic monuments at Torun. A trial study', (in Polish with a French summary), *Biblioteka Muzealnictwa i Ochrony Zabikow* (Warsaw), B 11 (1965), pp. 181–83.

Dobrzyce and the churches at Okonin, Ostrzeson and Torun with polyvinyl acetate and polyvinyl alcohol.

The Yugoslav Institute for the Protection of Historic Monuments[1] devised a solution of polyvinyl acetate (2·5%) and silicon resin (0·5%) in nitrocellulose varnish for fixing the pigments of aqueous Nubian paintings. By spraying this solution on to the mural surface and immediately covering it with polyethylene sheets, the resin was made to permeate to a depth of 5 mm. and the painted layer and the base became solid and water-resistant.

According to Schuster-Gawlowska,[2] the mural paintings of St. Augustine on the portico of the Augustine monastery at Cracow were treated with polyvinyl acetate. This resin was not only used as a surface preservative but also as a hardner and binding paste and as a fixative for bits of paint which had been removed by the 'distacco' method. The resin was found to be in a satisfactory condition even after seven years.

The flaking pigments from a fifteenth century English pulpit in the church of South Burlingham,[3] England, were secured with a weak solution of polyvinyl acetate in alcohol. The pigments of some Australian aboriginal[4] bark paintings were fixed with 8% bedacryl 122× solution in xylene-toluene mixture.

According to Jedrzejewska,[5] two recently-excavated one thousand years old Faras paintings were preserved with polyvinyl acetate aqueous emulsion. Similarly, sixty-two Byzantine paintings from Faras, Nubia, were preserved with polyvinyl acetate emulsion.[6]

The wall paintings in the medieval churches in Finland[7] were fixed with chalk water and casein, and in some cases a 2·5% solution of polyvinyl acetate emulsion was used for their preservation. Pokorny[8] has reported the use of clatolin glue and French skin glue in distilled water as an adhesive for mounting some stripped frescoes in Tyrol.

Bhowmik[9] has reported the use of a weak solution (1%) of polymethyl methacrylate in toluene for protecting the pigments of Indian miniature paper paintings. The

[1]M. Vunjak and M. Medik 'Removal and transferral of wall paintings from Nubia', *Zbornik Zastite Spomenika Kulture* (Belgrade), vol. 16 (1965), pp. 29–40.

[2]M. Schuster-Gawlowska, 'Analyses of the reaction of polyvinyl acetate on wall paintings subjected to conservation treatment' (Polish), *Biblioteka Muzealnictwa i Ochrony Zabikow* (Warsaw), B 11 (1965), pp. 191–204.

[3]Pauline Plummer, 'Restoration of a Fifteenth-century English Pulpit', *Studies in Conservation*, vol. 10, no. 4 (November, 1965), p. 173.

[4]W. M. Boustead, 'Conservation of Australian aboriginal bark paintings with a note on the restoration of a New Ireland wood carving', *Studies in Conservation*, vol. 11, no. 4 (November, 1966), p. 199.

[5]H. Jedrzejewska 'The conservation of the two wall paintings from Faras', *Biuletyn Muzeum Narodowego w Warszawie* (Warsaw), 9, (1965), pp. 217–61.

[6]Hanna Jedrzejewska, 'Problems in the conservation of wall paintings from archaeological excavations' (Polish), *Muzealnictwa Biblioteka Muzealnictwa i Ochrony Zabytkow* (Warsaw), B 11 (1965), pp. 237–54; also 'The conservation of wall-paintings from Faras', *Bulletin du Musee National de Varsovie* (Warsaw), vol. 7, no. 3 (1966), pp. 81–89.

[7]V. Kiljunen, 'The conservation of wall paintings in Finnish medieval churches', (Danish), *Med. Kon.* (Fyn, Denmark), 3 (1966), pp. 29–39.

[8]E. Pokorny, 'The transfer of a fresco painting in Tyrol' (German), *Maltechnik* (*Munich*), vol. 73 (1967), no. 2, pp. 37–43.

[9]Swarna Kamal Bhowmik, 'A Non-Aqueous Method for the Restoration of Indian Miniature Paintings', *Studies in Conservation*, vol. 12, no. 3 (August, 1967), p. 119.

author seems to have overlooked the serious drawback in the use of this resin, which, as discussed earlier, tends to become irreversible with age due to cross-linking.

The brief review of the literature shows that polymethyl methacrylate has generally not found favour with conservators, although, as discussed earlier, Kostrov and his co-workers have used polybutyl methacrylate with remarkable success in the conservation of mural paintings on loessic plaster. This polymer has not been tried on Indian murals and its behaviour under tropical conditions has yet to be studied. The cyclohexenone-formaldehyde resins have also not been used on Indian murals. Similarly the use of N-hydroxy methyl nylon as a fixative of painted surfaces has not been reported from any site in India.

The polyamide expoxy resin[1] forms an impermeable barrier, but its irreversibility is a great disadvantage and may cause difficulties, should it become necessary to remove it after use. In hot and humid climate, carboxymethyl cellulose sodium salt may undergo alteration. Bedacryl has also not been used on Indian wall-paintings. As the behaviour-pattern of these synthetic materials under tropical conditions is yet to be determined, it would be injudicious to carry out large-scale preservation of murals with these resins.

One is tempted to make use of preservatives reported upon in the literature, but the indiscriminate use of synthetic materials without a proper knowledge of their essential properties and their behaviour under different climatic conditions can prove disastrous. New materials should, therefore, be used for preservation of Indian murals only after their properties and behaviour under tropical conditions have been ascertained by adequate field tests.

Polyvinyl acetate dissolved in toluene-ethyl alcohol mixture containing 1–2% dibutyl phthalate is the chief preservative, consolidant and adhesive currently in use on Indian wall-paintings. The murals at Ajanta, Ellora, Bagh and other sites have been preserved with the vinyl resin. Over the years, no undesirable effects have been produced by this polymer nor has it shown any appreciable insolubility or discolouration under the prevailing hot and humid environment. Its use as an adhesive for loose plaster and as an impregnant for painted surfaces has proved to be very satisfactory. Polyvinyl acetate has stood the test of time under tropical conditions and is at present the best preservative for Indian murals.

8. ACKNOWLEDGEMENTS

The results presented in this paper are the outcome of the co-operative efforts of my colleagues in the Chemical Branch of the Archaeological Survey of India, and it is a pleasure to record how very thankful I am to them for the patient and hard work which they put in under my personal guidance and technical advice and furnished valuable practical data on the conservation of the mural paintings. Grateful acknowledgement is made of the field data furnished among others, by Shri M. S. Mathur, Deputy Superintending Archaeological Chemist and Sarvashri D. P. Puri, B. R. N. Sharma and A. K. Gupta, Assistant Superintending Archaeological Chemists, and Sarvashri B. P. Kanotra, G. Ramachandran, S. C. Shankhdhar, R. S. Tewari and G. Venkateshvaran, all Chemical Assistants, in the Archaeological Survey of India. My best thanks are due to Shri D. S. Kumayan, Photographer, Grade I, for preparing the photographic record presented in the paper.

[1]Sheldon Keck and Robert L. Feller, 'Detection of an Epoxy-Resin Coating on a Seventeenth-century Painting', *Studies in Conservation*, vol. 9, no. 1 (February, 1964), pp. 1–6.